QUEENSLAND HERBARIUM
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REVISION OF THE GENERA CYMBOPOGON AND SCHIZACHYRIUM (GRAMINEAE) IN AUSTRALIA

by S. T. BLAKE†

Queensland Herbarium, Brisbane

SUMMARY

Of the seven species of *Cymbopogon* and seven of *Schizachyrium* found in Australia, *C. queenslandicus, S. crinizonatum, S. dolosum, S. occultum* and *S. perplexum* are described as new. These, and also *C. bombycinus, C. obtectus, C. procerus* and *S. pachyathron* are restricted to Australia. *C. ambiguus* extends to Timor. *C. globosus* is a Malesian species now reported from Queensland. *C. refractus* extends eastward to Hawaii and Mangareva. *S. fragile* and *S. pseudeulalia* have wide ranges outside Australia.

The species of *Cymbopogon* are tufted often tall aromatic perennials found growing in sandy or stony soils or among rocks; one or more species is found in every mainland state. Distinguishing characters are found in the distribution and relative length of the hairs in the racemes, the shape and nervature of the lower glume of the sessile spikelet. *C. ambiguus, C. bombycinus* and *C. procerus* have permanently suberect not finally reflexed racemes. *C. bombycinus* is unique in having pubescent spatheoles and broad flattened recurving old leaf sheaths. *C. globosus* differs from the others in its relatively short inflorescences and in having the spikelets of the homogamous pairs greatly reduced or caducous. *C. refractus* differs from all other species of the genus in the relatively stout often nearly or quite glabrous joints and pedicels and persistent somewhat uncinate pedicellate spikelets. A few plants appear to be hybrids mostly with *C. refractus* as one parent. The species appear to be of minor value as forage plants but some are quite ornamental.

All species of *Schizachyrium* are small slender annuals found chiefly on sandy often shallow soils often in open habitats in the northern and north-eastern parts of the continent. Useful diagnostic characters were found in the dorsal or lateral compression of the spikelet, as well as its shape in dorsal view, the shape and direction of the callus-scar, the embryo, the hair-pattern on the joints and pedicels, and the ratio of length of leaf-blade to its sheath. Most species are very variable.

† Died 24 February 1973.

INTRODUCTION

This paper is concerned with an account of the species of *Schizachyrium* and *Cymbopogon* that have been found in Australia and may be regarded as the second part of "Monographic Studies in Australian Andropogoneae" of which the first part constitutes Univ. Qd Pap. Dept. Biol. 2, No. 3 (1940). A discussion on generic limits and the identification of some species dealt with here and other allied species appeared in Proc. Roy. Soc. Qd 80:73–81, Text-fig. 1, L–N (1969).

The work on which these papers were based has been carried out intermittently since about 1940. During this period a large number of collections has been accumulated, many of them consisting of very numerous individuals so that it has been possible to appreciate the range of variation that can be expected in a local population, the freedom with which two or more species grow mixed and the ease with which species can be inadvertently mixed when collecting. In 1964–5 I was able to study the collections at Kew and other herbaria in Europe and to become familiar with specimens of the genus throughout its range. This was especially valuable because two Australian species have a wide range outside Australia and one of these has been confused with a closely allied well known and widely spread species. I am very grateful to the directors of the herbaria listed below for the privilege of examining material of these in the herbarium itself or on loan at Kew or Brisbane. These herbaria are Harvard Herbaria, Cambridge, U.S.A. (A), Botanischer Garten und Botanisches Museum, Berlin (B), British Museum (Natural History) (BM), Queensland Herbarium, Brisbane (BRI), Herbarium Australiense, Canberra (CANB), Royal Botanic Garden, Edinburgh (E), Chicago Museum of Natural History (F), Conservartoire et Jardin botaniques, Geneva (G), Royal Botanic Gardens, Kew (K), Rijksherbarium, Leiden (L), Staatssammlung, Munich (M), National Herbarium of Victoria, Melbourne (MEL), Missouri Botanic Garden, St. Louis (MO), National Herbarium of New South Wales, Sydney (NSW), Museum National d'Histoire Naturelle, Paris (P), Western Australian Herbarium, Perth (PERTH), Naturhistoriska Riksmuseum, Stockholm (S), University of Utrecht (U), Naturhistorisches Museum, Vienna (W).

References to literature are restricted to protologues and works mentioned in discussions.

SCHIZACHYRIUM

Schizachyrium Nees, Agrost. Brasil. 331 (1829); Stapf, Fl. Trop. Afr. 9:185 (1917); A. Camus, Ann. Soc. Bot. Lyon 70:87–91 (1924); Jacques-Félix, Rev. Internat. Bot. Appliq. 22:423 (1953); Roberty, Boissiera 9:216–39 (1960); Clayton, Kew Bull 17:468–9 (1964); S. T. Blake, Proc. Roy. Soc. Qd 80:73–81, Text fig. 1, L–N (1969).

Heterochloa Desv. Opusc. 66 (1831). Type: *Heterochloa alopecurus* Desv.

Pithecurus Willd. ex Kunth, Enum. Pl. 1:490 (1833) *in syn.*

Andropogon L. sect. *Schizachyrium* (Nees) Benth. Fl. Aust. 7:529 (1878) and in Benth. & Hook. Gen. Pl. 3:1134 (1883); Pilger, Natűrl. Pfl.-fam. ed. 2, 14e:166 (1940); Hitchc. Man. Grasses U.S. ed. 2 (rev. Chase):749 (1951).

Andropogon L. subgen. *Schizachyrium* (Nees) Hack. in Mart. Fl. Brasil. II 3:296 (1883), Natűrl. Pfl.-fam. ed. 1, II 2:27 (1887), Monogr. Andropog. 361 (1889).

Andropogon spp. Kunth, Enum. Pl. 1:488–90 (1833); Steudel, Synops. Gram. 1:365, etc. (1859); Hitchc. U.S. Dept. Agric. Bull. 772:266 (1920).

Spikelets 2-nate, those of each pair differing in sex and mostly also more or less in shape and size, one sessile, the other pedicelled, on the articulate fragile rhachis of several- to many-jointed (rarely few-jointed) solitary racemes terminating the culms and their branches, supported by bladeless sheaths (spatheoles) and frequently collected into false panicles, the sessile spikelets falling with the contiguous joint and the accompanying pedicelled spikelet; joints and pedicels thickened upwards and often rather stout, straight (not arcuate), the joint and often also the pedicel deeply excavated at the often ± oblique top, giving rise to a scarious cupuliform and ± dentate terminal appendage. Florets 2, at least in the sessile spikelets, the lower reduced to its lemma, the upper hermaphrodite in the sessile spikelets, neuter or both suppressed in the pedicelled spikelets. Sessile spikelets dorsally to laterally compressed, nearly always awned; callus short, mostly quite obtuse, shortly bearded at the base, the scar oblique to nearly vertical, from a little broader than long to about twice as long as broad. Glumes equal or subequal, lower chartaceous to subcoriaceous, more or less convex (to subterete) on the back at least in the lower part, sharply 2-keeled with sharply inflexed margins at least from the middle upwards, the margins often narrow, delicate and (usually) ± ciliate or ± thickened downwards sometimes in part only, the keels approaching one another towards the tip and running out into teeth or mucros, and with 2 or more often fine and sometimes very obscure intracarinal nerves; upper thinner to membranous, narrowly boat-shaped to dorsally flattened, keeled (at least upwards), 1–3-nerved, the delicate margins ciliolate. Lemmas hyaline, of the lower floret often membranous downwards and ± 2-nerved, ciliolate and often purplish, of the upper usually 2-fid sometimes very deeply, or 2-dentate, rarely entire, commonly ciliolate, nearly always awned, the awn from the sinus or continuing the entire lemma. Palea absent or minute and hyaline. Lodicules 2, thin, glabrous, ± cuneate. Stamens 3, rarely 2. Stigmas laterally exserted low down if at all; styles terminal. Grain narrowly linear very narrowly elliptic or somewhat ovate in outline, subterete or dorsally distinctly compressed; embryo $\frac{1}{3}$–$\frac{1}{2}$ the length of the grain, sometimes thicker than the endosperm. Pedicelled spikelet subsimilar to the sessile but usually relatively broader and flatter or ± reduced, sometimes very much reduced, much smaller, adnate to and appearing as a continuation of the pedicel. Glumes ± membranous, the lower aristulate or muticous, the upper sometimes absent. Lemmas, if present, hyaline, ciliate, muticous.—Annual or perennial grasses, rarely suffrutescent (African spp.), commonly drying off to a bright reddish colour, never very tall. Culms slender. Leaf-blades folded in bud, usually narrow. False panicles varying from very loose and scanty to densely fascicled with the spatheoles mostly very narrow, scarious membranous or lower down herbaceous.

About 60–70 species, cosmotropical.

The species of *Schizachyrium* have been frequently treated as belonging to *Andropogon,* sometimes as a subgenus or section as may be seen from the synonymy given above. The solitary terminal raceme has frequently been relied upon as the chief character distinguishing the group from *Andropogon,* but solitary racemes are found in a few species of *Andropogon* sect. *Leptopogon* and Jacques-Félix loc. cit. and Clayton loc. cit. have emphasized that in *Schizachyrium* the lower glume of the sessile spikelet is ± convex and firm (thinly chartaceous to thinly coriaceous) with intracarinal nerves, the joints and pedicels are straight and ± widened upwards and sometimes stout with the tip (at least of the joint) deeply hollowed into a cup with a fimbriate or denticulate rim, while in *Andropogon* sect. *Leptopogon,* the lower glume of the sessile spikelet is concave, hyaline and nerveless between the keels and the joints and pedicels are linear to filiform, arcuate and with shallowly cupuliform tips. To these differences I would add that the grain of *Schizachyrium* is ± convex on the side facing the lower glume (i.e. the face with the hilum at base) while in *Andropogon* sect. *Leptopogon* the grain—so far as I have seen it—is ± distinctly concave or channelled along this side.

There are two well-marked groups within the genus as keyed out by Stapf (1917) and Jacques-Félix, and more fully discussed by Clayton. The Australian species all belong to Clayton's *Section A,* with the sessile spikelet narrower or but little wider than the joints and pedicels, its lower glumes chartaceous to thinly coriaceous with faint and slender intracarinal nerves, the upper glume laterally compressed and the upper lemma 2-lobed almost to base. Jacques-Félix recognized and described four sections in West Africa; sect. *Brevifolia* and sect. *Urceolata* could include Australian species, but some species do not agree with the characters of any section.

A review of the genus was given by A. Camus loc. cit. but this is merely a list of species recognized with synonymy, including several new transfers based on Hackel's work without keys or critical notes of any kind. *S. fragile* (R. Br.) A. Camus is the only species recognized from Australia but it is reasonably certain that no specimens were seen.

Roberty's treatment is part of a general revision of the Andropogoneae which has been commented upon elsewhere (Blake op. cit. 58, Clayton Proc. 9th Internat. Grassl. Congress 1131 (1965)). I cannot agree with his sorting of specimens or his classification and his new combinations for infraspecific taxa are invalid, being contrary to Art. 4 of ICBN.

The Australian species are all slender annuals with the racemes usually ± completely hidden by the spatheoles before maturity, glabrous or nearly so except for the inflorescence and some hairs near the ligule and sometimes below the nodes especially the upper ones and sometimes at the base of the sheaths, base of the blades or collar; culms several to many-noded, ± compressed, the alternate edges of contiguous internodes ± flattened to channelled especially in the upper part and in the upper part of the plant, the margins of the channel ± scaberulous to ciliolate especially on the upper part of the upper internodes, otherwise glabrous and usually smooth, branched except in young or arrested plants, the branches solitary or up to several together, those from the lower nodes often several-noded and then commonly rebranched, those from the upper nodes of main culms or branches 1-noded, each ending in a raceme. Leaf-sheaths are ± compressed, usually conspicuously so and strongly keeled at least above the middle, striate, glabrous or the hyaline margins ± scaberulous and sometimes with a few hairs on the collar, shorter to much shorter than the internodes if the plants are well developed; ligule membranous, short, about equally high throughout, ciliolate, adnate to auricles of the leaf sheath and with a line of hairs at the junction sometimes with appressed hairs on the back which may be conspicuous especially on the upper leaves; blades linear, glabrous or nearly so on the back. Spatheoles are herbaceous with narrow hyaline margins commonly convolute below and boat-shaped upwards at and after maturity often becoming flat, usually ± completely covering the straight dense racemes; when flattened they are narrowly linear-elliptic or somewhat ovate-linear, acute, glabrous, the herbaceous part often ± asperulous on the nerves, sometimes permanently convolute if the peduncle is very long. Peduncles are commonly much shorter than the spatheole, sometimes about as long to longer when terminating the main culms. Joints and pedicels are a little shorter to a little longer than the sessile spikelet, usually about equal in length but different in appearance with the pedicels narrower and more compressed and sometimes with different indumentum. Sessile spikelets are 3·5–10 mm long, narrowly to very narrowly more or less ovate, ± elliptic or ± oblong, commonly cleistogamous. Lower lemmas vary from about ⅔ as long to as long as the glumes, nerveless, or very finely 2-nerved. Upper lemmas are about ¾ as long as the glumes, divided nearly to the base with a perfect awn the column of which is from about as long up to almost twice as long as the sessile spikelet. Anthers vary in length in the same flower. Pedicelled spikelets are very much reduced, narrowly subtriangular, adnate to the pedicel and from the front appearing as a continuation of the latter consisting of a much reduced 3(–5)-nerved, awned and sometimes toothed lower glume rarely with a minute rudiment of the upper glume.

The Australian species are found mostly on sandy or stony often shallow soil, often in company with other annual plants either on disturbed ground or between tufts of taller perennial grasses in *Eucalyptus* forest. Only rarely have they been found on clay soils. Sometimes two or three species have been found growing together. They are very variable, especially in habit, indumentum of joints, pedicels and sessile spikelets and size of the sessile spikelets, and the best diagnostic characters lie in the dorsal or lateral compression and form of the sessile spikelet, its callus and callus-scar, and details of the lower glume, the pattern of the indumentum on the joint, to some extent the shape of the joint and pedicel, and the relative length of the leaf-blade to its sheath.

Variations in habit must be at least partly the result of the environment and age of the plants and weather conditions. If there is plenty of room and soil moisture, individual plants tend to produce tufts of culms and well exserted internodes; the culms soon branch from the upper nodes and later from the lower and middle nodes, the lower branches often resembling the main culms though usually with fewer nodes and often rebranching. Frequently however plants are more crowded sometimes very densely so, and then commonly consist of a single culm; if growth takes place under "adverse" conditions of shallow soil and rapid depletion of soil moisture individuals may be solitary unbranched culms of less than 5 cm in height ± covered by the leaf-sheaths and with a single raceme. There are other variations that seem to be independent of the habitat. All the Australian species have very short peduncles except that the raceme terminal on the main culm is sometimes long pedunculate with the raceme much exserted from the spatheole and the spikelets of such racemes are at least sometimes chasmogamous with larger well exserted anthers. In any raceme the lowermost and uppermost sessile spikelets differ from one another and from the rest of the spikelets, the uppermost being always smaller, often narrower with narrower wings if these are present, and the lowermost sometimes larger, usually less hairy (if others are hairy) and there are sometimes differences in relative length or indumentum of the joint and pedicel; these spikelets have been ignored in drawing up descriptions, but otherwise there is relatively little variation between the spikelets on a plant and usually little between the spikelets of a single collection, however copious. The joints are relatively constant in shape within a species and within the genus there are three main patterns of indumentum each liable to considerable modification. There is the one common in the Andropogoneae, the ciliate joint with a line or very narrow band of hairs along each margin but this pattern is rarely well developed and in some species the hairs may be so reduced that the joint appears glabrous though with more or less scaberulous margins. A second pattern, perhaps peculiar to the genus is the development of a dense horizontal or oblique band of long hairs from one margin to the other about or above the middle. The third pattern is a diffuse distribution of long hairs over the whole or part of the back sometimes denser at the margins. The basic hair-pattern on the joint is a good diagnostic character but the first and second patterns are sometimes obscured by the superposition of the third which is the least reliable. The pedicel tends to resemble the joint in hair pattern but sometimes not very closely. The lower glume of the sessile spikelet may be glabrous or hairy with short or long hairs or both over a greater or less part of the back. The indumentum or lack of it on the glume has no diagnostic value though it is constant on a plant and usually constant in any given population. The absolute size of the sessile spikelet varies considerably in some species, the larger ones being twice as long as the smaller ones even when occasional extremes are excluded. Increase in length is often not accompanied by increase in width or size of grain; it is an attenuation of the upper part of the spikelet. The size of the callus, measured from the point of attachment of the upper glume is constant within limits for each species and the shape and inclination of the scar also provide useful characters. Variation in the form of the sessile spikelet allows the species to be readily arranged in two groups. In one of these the spikelets are dorsally compressed with the lower glume flattened on the back to gently convex and sharply 2-keeled from the tip at least to the middle; in the other species the spikelets are laterally compressed much narrower, with the lower glume very much convex on the back (especially in the lower part) and sharply 2-keeled only from or above the middle. These differences are associated with differences in the embryo and foliage as given in the key below. The thickness of the raceme, excluding hairs and awns, is dependent on the combined width and thickness of joint, pedicel and sessile spikelet.

KEY TO SPECIES

Sessile spikelets dorsally compressed, 4–8 times as long as wide; lower glume sharply 2-keeled down to the middle or beyond, the keel sometimes winged, the back slightly convex downwards; grain with the embryo indistinctly or not trigonous, not or but little thicker than the endosperm; leaf-blades gradually or abruptly narrowed to the base, 0·8–5·5 mm wide:

Lower glume of sessile spikelet winged, at least above the middle, the keels prominent to the base, usually polished smooth but often also hairy, acuminate or not; joints and pedicels at least usually hairy; callus-scar nearly erect; leaf-blades not much narrowed to the base, narrower than the sheath:

Joints with a dense oblique beard of long hairs running from the inner margin to near the top of the other margin, the remainder hairy or glabrous or the margins ± ciliate; awn of sessile spikelet 9–15 mm long, the column occupying about half its length or a little more, exserted by up to 2 mm or not at all; sessile spikelet somewhat narrowly ovate acuminate to very narrowly suboblong, acute or obtuse, 0·7–1·1 mm wide; callus longitudinally furrowed in front, its scar distinctly longer than wide and ± obovate: 1. *S. fragile*

Joints diffusely hairy at least below, glabrous or with a glabrous patch below the tip so that there may be an irregular loose series of hairs below the tip, never with the well developed oblique band of *S. fragile,* the margins ciliate or not; awn of sessile spikelet 16–30 mm long, the column occupying less than half the length, exserted by 3–6 mm, sometimes up to the length of the glumes; sessile spikelet suboblong to very narrowly elliptic, acute to subtruncate, up to 1·6 mm wide; callus broadly ± depressed in front but not longitudinally furrowed.

Spikelets 3·5–4·5 mm long, 0·6–0·7 mm wide, narrowly elliptic acute; lower lemma nerveless; column of awn 6–7 mm; raceme 3–5-jointed, 0·7–0·9 mm thick; joint 0·6 mm wide at top; ligule 0·7–0·9 mm 2. *S. perplexum*

Spikelets 5–8 mm long, 1·3–1·6 mm wide, nearly oblong to sub-ovate or subelliptic, usually very obtuse; lower lemma distinctly 2-nerved; column of awn 8·5–11 mm; racemes 6–10-jointed, 1·5–2 mm thick; joint 0·75–1·3 mm wide at top; ligule 0·2–0·6 mm 3. *S. pachyarthron*

Lower glume of sessile spikelet neither winged nor marginate, ± papillose-scabrous, glabrous or hairy, acutely ± acuminate; joints and pedicels glabrous or ± ciliate or diffusely hairy; callus not longitudinally furrowed in front, its scar transverse rather than erect in profile, in face view subcircular to somewhat ovate or somewhat reniform; leaf-blades rounded at base, about as wide as the sheath 4. *S. pseudeulalia*

Sessile spikelets ± laterally compressed, 7–13 times as long as wide; lower glume sharply keeled only in the upper ½–⅓ with the keels neither marginate nor winged, very much convex on the back downwards with the flaps there incurved; grain with a ± trigonous embryo thicker than the endosperm; leaf-blades gradually narrowed or not much constricted to base, 0·6–2 mm wide:

Joints and pedicels very slender with a dense ± horizontal band of long hairs above the middle, the pedicels about linear, 0·2–0·3 mm wide; callus curved, acute, the scar narrowly obovate to narrowly subelliptic; racemes ± 0·5 mm thick; leaf-blades not ciliate at and near base 5. *S. crinizonatum*

Joints and pedicels ± stout to very stout the former sometimes conspicuously stouter than the sessile spikelet, the latter narrowly ovate or obovate 0·5–1 mm wide, both hairy with the hairs marginal or diffuse, not in a clearly marked transverse band; callus straight or nearly so, the scar ovate or somewhat narrowly ovate to elliptic or slightly obovate; racemes ± 1–1·5 mm thick; leaf-blades ciliate at and near base:

Pedicel narrowly ovate, more conspicuous than and simulating the sessile spikelet in appearance, the spikelet itself inconspicuous and closely wedged between joint and pedicel about 9–13 times as long as wide (0·35–0·5 mm wide); callus-scar broadly elliptic to ± ovate, about as wide as long or nearly so; upper lemma glabrous, its awn 9–13 mm long with a column of 4–5 mm 6. *S. occultum*

Pedicel obliquely narrowly obovate not at all resembling a sessile spikelet, the spikelet 7–10 times as long as wide (0·55–0·9 mm wide); callus-scar ± narrowly ovate to ovate or elliptic-ovate up to 3 times as long as wide; upper lemma ciliolate, its awn 12–18 mm long with a column of 6–8 mm 7. *S. dolosum*

1. **Schizachyrium fragile** (R. Br.) A. Camus, Ann. Soc. Linn. Lyon 70:87 (1924); S. T. Blake, Proc. Roy. Soc. Qd 80:80 (1969). Based on *Andropogon fragilis.*

Andropogon fragilis R. Br. Prodr. 202 (1810). Type: Queensland, Endeavour R., *Banks & Solander* (BM, holo, photo and fragment BRI; NSW).

Pollinia fragilis (R. Br.) Spreng. Syst. Veg. 1:289 (1825). Based on *Andropogon fragilis.*

Andropogon obliquiberbis Hack. Flora 68:117 (1855). Type: New Caledonia, near Balade, *Bieillard* 1506 (K, iso).

Sorgum obliquiberbe (Hack.) O. Kuntze, Rev. Gen. Pl. 2:792 (1891). Based on *Andropogon obliquiberbis.*

Schizachyrium obliquiberbe (Hack.) A. Camus, Ann. Soc. Linn. Lyon 70:89 (1924). Based on *Andropogon obliquiberbis.*

Andropogon brevifolius. Sw. var. *fragilis* (R. Br.) Hack. in DC. Monogr. 6:364 (1889). Based on *Andropogon fragilis* but the plant described belongs to *S. pseudeulalia.*

Andropogon fragilis R. Br. var. *sinensis* Rendle, J. Linn. Soc. Bot. 36:372 (1905). Type: China, Whampoa, French I., *hb. Hance 1388* (K, holo).

Schizachyrium fragile (R. Br.) A. Camus var. *sinense* (Rendle) P. Jansen, Reinwardtia 2:338 (1953). Based on *Andropogon fragilis* var. *sinensis.*

Eulalia simplex Hosokawa, Trans. Nat. Hist. Soc. Formosa 28:150 (1938). Type: Caroline Islands, Yap, *Hosokawa 8839* (A, iso).

Schizachyrium brevifolium (Sw.) Nees ex Buse subvar. *fragile* (R. Br.) Roberty, Boissiera 9:235 (1960), *nomen invalium.* Based on *Andropogon fragilis* but the specimens cited belong to *S. pseudeulalia.*

Schizachyrium sanguineum (Retz.) Alston subvar. *obliquiberbe* (Hack.) Roberty, Boissiera 9:222 (1960), *nomen invalidum.* Based on *Andropogon obliquiberbis.*

Culms up to 50 cm long, usually erect or nearly so, 0·8–1·1 mm thick, mostly 7–9-noded, lower internodes sometimes puberulous near the nodes the uppermost pubescent or with a tuft of hairs below the node, usually only sparsely branched. Leaf-sheaths sometimes puberulous at base; collar pubescent or scaberulous; ligule 0·3–0·6 mm long; blades usually folded, narrower than the sheath, narrowed but not rounded at the base and this part ciliate with fine hairs mostly 1–2 mm long from very small tubercles, gradually narrowed from well above the middle to a narrowly obtuse to acute tip, scaberulous on the margins, scabrous on the keel in the upper part, pubescent behind ligule otherwise glabrous, upper surface minutely and very sparsely asperulous or both surfaces smooth, about 2–6·5 cm long, 1–3 mm wide when flattened, from about as long as the sheath up to twice or even 2·5 times as long. Spatheoles boat-shaped or at length nearly flat for the greater part, sometimes with a rudimentary blade, sometimes with a few hairs at the top, 3·5–5·5 (–7) cm long, 4–6 mm wide when flattened, asperulous. Peduncles villous on expanded tip, 5–15 mm long. Racemes 7–12-jointed, about 3–6 cm long, 0·9–2·2 mm thick, nearly completely enclosed in the spathes. Joints and pedicels about equal in length but otherwise dissimilar; joints gradually broadened upwards from the base, 0·3–0·5 mm wide, the tip 0·8–1·1 mm wide and 0·6–0·7 mm thick, quite oblique, ± 2-toothed, very convex on the back, the edge against the lower glume of the sessile spikelet densely long villous-ciliate in the lower part, the band of hairs (up to 3·5–4·5 mm long) then running obliquely across the back towards the top of the other edge this edge also densely villous-ciliate to glabrous, the rest of the back glabrous or variously hairy, sometimes shortly pubescent especially on the part below the transverse band (beard), if villous then with a narrow glabrous band delimiting the beard; pedicels very narrowly obliquely obovate to obliquely obovate-linear, 0·6–0·7 mm wide upwards, 0·25–0·4 mm wide at base, subtrigonous, flat on the back, the edge against the joint ciliate like it, the other ciliate throughout or in the upper part only, the back glabrous or variously hairy, sometimes with a ± distinct, ± oblique transverse beard. Sessile spikelet dorsally compressed, the upper glume visible throughout its length between joint and pedicel, narrowly to very narrowly ovate acuminate to very narrowly suboblong, acute or obtuse, 5–9 (–10) mm long, 0·7–1·1 mm wide, (4–) 5–8 times as long as wide, wider than the thickness of the joint; callus obtuse, 0·45–0·65 (–0·95) mm long, furrowed longitudinally in front, bearded with hairs up to 1·3–3 mm long; callus-scar broadly obovate, obovate, or subelliptic, 0·35–0·5 (–0·55) mm long, 0·2–0·35 mm wide. Lower glume thinly coriaceous, 2-keeled throughout, marginate to broadly winged in the upper ⅖–½ or almost to base, the wings gradually narrowed to the tip or abruptly irregularly rounded, gradually disappearing below the middle, flaps often nearly meeting in the upper part 0·15–0·3 mm wide, back convex throughout with 3–5 fine or obscure intracarinal nerves, glabrous throughout or pubescent to villous in the lower part, sometimes also ± puberulous in upper part and wings. Upper glume about as long, 1--3-nerved with the lateral veins very fine, keel winged, sometimes irregularly toothed. Lower lemma ⅔–¾ as long as the glumes, nerveless or finely 2-nerved. Upper lemma with an awn 9–15 mm long, the column scarcely exserted or exserted by up to 2 mm, sometimes longer than the bristle. Anthers 0·4–0·9 mm long. Grain very narrowly ovate or narrowly elliptic, obtuse or ± acute, subplanoconvex, 2·1–4 mm long, 0·6–0·8 mm wide, 0·4–0·5 mm thick; embryo often thicker than the endosperm, obscurely to definitely trigonous below, ⅓–½ as long as the grain. Pedicelled spikelet 1·5–3·5 mm long, densely ciliate on both margins; awn 1·5–11 mm long. Figs. 1A, 2.

WESTERN AUSTRALIA.—Northern Province: Merny's Creek, upper Glenelg R., July 1950, *Gardner* 9650 in part; Goody Goody, Apr. 1905, *Fitzgerald;* Meda Stn., Apr. 1905, *Fitzgerald* 364; Invanhoe Stn., light sandy soil, July 1952, *Lee* 320. Eremean Province: 710 M.P. on Rabbit Proof Fence, 19 miles N. of Christmas Creek [ESE of Nullagine and E of Oakover R.], in red stony soil on bare hill top, May 1947, *Royce* 1768.

NORTHERN TERRITORY.—Darwin and Gulf District: Nightcliff, Darwin, in *Eucalyptus tetrodonta* open forest on truncated laterite podsol, Apr. 1948, *Specht* 180, near Hayes Creek, 13° 35½′ S, 131° 28′ E, on damp sandy soil carrying *Banksia, Acacia, Verticordia, Pandanus* etc., ± 107 m, June 1946, *Blake* 16189A; 20 miles about S of Katherine, Mar. 1946, *Hartley;* 40 miles SW of "Dorisvale", May 1952, *Lazarides* 2798; near headwaters of Flora R., 54 miles SW of "Dorisvale", May 1952, *Lazarides* 2811. Victoria River

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District: "Willeroo", May 1935, *Mathieson;* 64·7 miles SE Top Spring Store, common in red sandy loam in woodland, Apr. 1959, *Chippendale* NT. 5812. Barkly Tableland District: N of Newcastle Waters, in lancewood (*Acacia* sp.) scrub, hard red ironshot soil, ± 240 m, June 1946, *Blake* 16028; near (S of) Newcastle Waters, parkland of *Bauhinia* and *Acacia,* reddish sandy soil, ± 240 m, common, June 1946, *Blake* 16021; 14 miles S of Elliott, common on roadside in spinifex country, Mar. 1955, *Chippendale* NT. 1066; O.T. Station, 16° 37′ S, 135° 3′ E, rough quartzite country, among *Triodia pungens,* 180 m, May 1947, *Blake* 17672; Three Nobs, 16° 31′ S, about 135° 30′ E, top of hill among sandstone boulders, 168 m, May 1947, *Blake* 17751; 24 miles S of Borroloola, stony ridge, shallow soil, Mar. 1972. *Byrnes* 2527.

QUEENSLAND.—Burke District: near "Wurung", approx. 19° 15′ S, 140° 30′ E, on low ridge among *Triodia* on reddish sandy soil, May 1935, *Blake* 8916; Carpentaria, *Gulliver;* Normanton, open low ridges on light grey gravelly sand, May 1935, *Blake* 8964, and on sand in shallow depressions and channels on low ridge slopes 0–15 m, May 1935, *Blake* 9036; Croydon, on low sandridge in regenerated forest of *Eucalyptus miniata* with *Aristida* spp., common, ± 120 m, Aug. 1943, *Blake* 15113, towards Croydon from "Esmeralda" (13 miles), sandy seepage slope dominated by *Melaleuca viridiflora,* July 1954, *Blake* 19616; about 40 miles from Mt. Isa on road to Camooweal in *Eucalyptus-Triodia* community on ridge with shallow stony red loam, 366 m, June 1946, *Blake* 15963; near source of Poison Creek about 90 miles N of Hughenden in *Eucalyptus-Callitris* forest on compact sand, 780 m, Apr. 1935, *Blake* 8491, 8493; 16 miles N of "Mt. Sturgeon" with *Eucalyptus exserta* on sandy soil, June 1953, *Lazarides* 3680; 14 miles N of "Mt. Sturgeon" on colluvial wash of Poison Creek, June 1953, *Lazarides* 3664. Cook District: Thursday I., June 1936, *Hockings;* Jardine R., ca long. 142° 21′ E, common on sandy messmate and bloodwood ridges, ± 15 m, May 1948, *Brass* 18831; Iron Range, occasional on stony soil in savannah forest, 50 m, June 1948, *Brass* 19131; Endeavour R., in 1770, *Banks & Solander;* Cooktown, in *Eucalyptus* forest on sandy soil, ± 30 m, July 1943, *Blake* 15061, and in scrubby *Melaleuca* forest on sandy soil, ± 6 m, July 1943, *Blake* 15041, and on Grassy Hill, among granite boulders, with scattered to clustered trees, May 1962, *Blake* 21844, and on levee of Endeavour R., cleared open forest, sandy soil, May 1970, *Blake, Correll & Stearn* 23214; "Wrotham Park", ca. 45 miles NW of Mungana, in *Eucalyptus tetrodonta-E. miniata* forest on fine whitish loose sand, Apr. 1938, *Blake* 13717; about 40 miles NW of Mungana in *Melaleuca* forest on fine whitish sand, Apr. 1938, *Blake* 13736; N of Chillagoe, near Walsh R., in *Eucalyptus-Erythrophleum* forest on sandy soil ± 300 m, Apr. 1938, *Blake* 13603; Chillagoe, in open forest on hard reddish soil, 345 m, Mar. 1938, *Blake* 13556; near Chillagoe, in damper places in open forest, grey sandy soil, 315 m, Apr. 1938, *Blake* 13571; Mt. Mulligan, Apr. 1939, *Pedler* 13, and Apr. 1941, *Flecker in NQNC.* 7361, 7366; Mt. Molloy, dry stony hillsides, 360 m, Apr. 1932, *Brass* 2462; Boyle Creek, NW of Mareeba, in *Eucalyptus* forest, 600 m, Apr. 1962, *McKee* 9158; Gorge Creek, 10 miles W of Mareeba, in dry ground, 400 m, Apr. 1962, *McKee* 9198; Cairns, on wet sandy forest land about sea-level, June 1935, *Blake* 9398, and on steep grassy hillsides, chiefly in damper places, Mar. 1938, *Blake* 13356; delta of Russell R., among shrubs, sandy soil, Jan. 1910, *Domin;* Mareeba, in mixed open forest on yellowish brown fine gravelly loam, 390 m, June 1935, *Blake* 9490, and in rather bare places in *Eucalyptus* forest, ± 390 m, Mar. 1938, *Blake* 13458; Watsonville, *Gallogby;* Cumberland, abundant on soils too shallow for perennial grasses, granite country, May 1937, *Brass* 8801; W of Einasleigh, upper slopes of Newcastle Range, scrubby *Eucalyptus* forest, reddish stony sandy loam, 670 m, July 1954, *Blake* 19514, 19517; Newcastle Range, Apr. 1907, *Blackman;* crest of western scarp of Great Dividing Range, 12 miles ± E of "The Lynd", in open forest on sandstone ridge, 540 m, July 1954, *Blake* 19479; Gilbert R., *Armit* 911. North Kennedy District: Lucinda Point, sandy land, Feb. 1923, *White;* near Rollingstone, roadside, Oct. 1942, *L. S. Smith* T.174; halfway between Townsville and

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Rollingstone in chiefly *Melaleuca* forest on pale hard soil, ± 10 m, Apr. 1945, *Blake & Webb* 15770, 15772; Townsville, on exposed slopes of Castle Hill on sandy soil, June 1934, *Blake* 5936, and on exposed rocky slope of Castle Hill, Mar. 1935, *Blake* 8172; N of Pentland, near Cape R., on hillside in *Eucalyptus* forest on sand, 375 m, Apr. 1935, *Blake* 8409; NE of Pentland near Campaspe R., in *Eucalyptus melanophloia* forest, dried out very shallow depression, ± 365 m, July 1954, *Blake* 19294; Pentland, on sandy creek bank in partial shade, 390 m, June 1934, *Blake* 6040A, and on hillsides in *Eucalyptus* forest, 390 m, June 1934, *Blake* 6077, and Feb. 1910, *Domin;* Ravenswood, in stunted *Eucalyptus* forest on shallow sandy soil, ± 300 m, Mar. 1943, *Blake* 14853; Whitsunday I., in sandy forest land near the sea, June 1934, *White* 10203. South Kennedy District: near (N of) junction of Campaspe and Cape Rivers in a stunted *Eucalyptus-Triodia* community on pale hard sandy soil, ± 240 m, Apr. 1945, *Blake & Webb* 15722; 27 miles WNW of Nebo, abundant on alluvial flat, June 1962, *Story & Yapp* 92; about 4 miles E of "Iffley" homestead abundant on damp sand, July 1962, *Story & Yapp* 139. Mitchell District: Torrens Creek, Oct. 1933, *Chisholm,* and Mar. 1933, *White* 8761, 8762; Main Range, Torrens Creek, *Pollock;* Barcaldine, Apr. 1919, *White;* Jericho, rather flat country, fine grey sand, *Eucalyptus* forest, 360 m, Nov. 1935, *Blake* 10263; Dividing Range near Jericho, 1910, *Domin.* Leichhardt District: Cometville, sandy soils, in 1879, *O'Shanesy* 4025. Port Curtis District: Curtis I., Apr. 1962, Queensland Naturalists Club; Curtis I., N of Southend, mixed open low forest on light grey very fine sandy soil, Mar. 1966, *Blake & Boyland* 22565; Rosedale, sheltered spot on side of granite mountain, May 1936, *Dovey* 837. Wide Bay District: Moorland, near Bundaberg, in railway enclosure through wallum scrub, Apr. 1936, *Blake* 11340; Elliott Railway Bridge, Dec. 1938, *Goy & Smith* 586; Fraser I., Sandy Cape in mixed open forest on deep sand, Apr. 1966, *Blake* 22703; Fraser I., E coast, N of Eurong Road, on loose sand at side of track through *Banksia* scrub, Aug. 1941, *Blake* 14406; Noosa, on sandy hillside near the sea, July 1943, *Smith & Smith,* and in *Eucalyptus* forest near the coast, very sandy soil, Apr. 1946, *Blake* 15935. Warrego District: "Chesterton" approx. 25° 20′ S, 147° 20′ E, in *Callitris* forest on loose sand, ± 540 m, Apr. 1936, *Blake* 11125; Charleville, amongst stones on railway track, 291 m, Jan. 1931, *Hubbard & Winders* 6119A; between Charleville and Westgate on red sand associated with *Eucalyptus melanophloia* and *Triodia,* Apr. 1934, *Blake* 5417. Maranoa District: Bollon—St. George road, yellow sand over billy, Apr. 1953, *S.Q.W.S.* 58; "Miltonise" about 30 miles W of St. George, on low sparsely timbered sandridge, ± 180–195 m, Mar. 1936, *Blake* 10783. Darling Downs District: between Inglewood and Milmerran, in light sandy soil under *Angophora* trees, Jan. 1934, *White* 9773; Goombungee. Jan. 1913, *White.* Moreton District: Coolum, in *Eucalyptus* forest on sand and on wallum slopes, Apr. 1938, *Blake* 13755; Beerburrum, open damp sandy places, May 1933, *Blake* 4824; Goodna, moderately common in open *Eucalyptus* forest, stony siliceous soil, June 1030, *White* 6774; Slacks Creek, *Eucalyptus* forest, on sand overlying coarse sandstone, Apr. 1970, *Blake* 23176; Brisbane district, June 1930, *Vickery* NSW 12425; Logan Village, moderately common in cleared paddocks, sandy soil, June 1930, *White* 6775; foot of Tamborine Mtn. on river bank, Mar. 1910, *Domin;* Coolangatta, in grey sandy soil, Jan. 1931, *Winders* 14; near Cape Moreton, Moreton I., in *Eucalyptus* forest and on wallum flats, also on coastal sands, May 1937, *Blake* 13070; Amity Point, Stradbroke I., rather common on hillside in sandy soil, Apr. 1930, *White* 6706.

NEW SOUTH WALES.—Western Plains: Narrabri West, June 1907, *Boorman.* North Coast: Copmanhurst, Apr. 1917, *Cheel.*

Also in southern China, Marianas, Caroline Islands, Aru Islands and New Caledonia. Specimens seen from these are cited in my paper of 1969 and mapped in Fig. 2.

S. fragile is one of the more variable species but the name has been commonly misapplied to *S. pseudeulalia* following Bentham's identification of specimens of the latter collected by Schultz and Mueller with Banks & Solander's specimens. Hackel accepted this identification but apparently saw only Schultz's collection, a specimen of which is in his herbarium now in Hb. Vienna in which I found no other Australian material. This interpretation has been commonly followed although Brown's description especially as to "rachibus sericeobarbatis" does not agree with *S. pseudeulalia*. Rendle seems to be the only botanist after Bentham to examine the type of *A. fragilis* and (1905, loc. cit.) drew attention to some of the differences between the type and Hackel's concept, but his note appears to have been ignored. Hackel at first treated his concept as a variety of *A. brevifolius* but later accepted it as a distinct species and both he and Merrill described varieties (see under *S. pseudeulalia*).

There is some variation in the indumentum of the racemes of the Banks & Solander material, but I am convinced all is conspecific. Brown described the lower glume of the sessile spikelet as glabrous and this is true for part of the material, but in some spikelets the lower glume is hairy. Rendle apparently did not notice these glumes nor did he recognize the characteristic oblique beard on the joints; it was chiefly on the hairy lower glume together with a more slender habit that he distinguished *A. fragilis* var. *sinensis*.

Boorman's collection from Narrabri West was reported by Maiden & Betche, Proc. Linn. Soc. N.S.W. 33:319 (1908), as *Andropogon brevifolius* Sw. with *A. fragilis* R. Br. as a synonym and a specimen with dissections was figured by Maiden in a more extensive account in Agric. Gaz. N.S.W. 20:1083 (1909) (also isued as Miscellaneous Publication, No. 1285). In both places it was stated that "The Narrabri specimens agree exactly with R. Brown's type-specimens from the Endeavour River". The authors apparently followed Hackel's misidentification but they did not notice how widely the specimens differed from Hackel's account of *A. brevifolius*.

In spite of the large number of collections, some very copious, hardly two exactly match. There is certainly variation in stoutness, but the most striking variations are in the indumentum of the raceme, the size of the sessile spikelet and, to a less extent, the shape of the latter; the extent of the variation may be understood from the description above. Generally speaking, the obliquely transverse beard of long hairs on the joint is an easily seen character by which the species can be readily recognized, but sometimes its distinctiveness is lessened by numerous other long hairs though these are less dense than the beard and are usually separated from it by a narrow glabrous line; *Blake* 13458 shows this condition. At the other extreme, the upper part of the beard is sometimes weakly developed on an otherwise nearly glabrous joint; *Blake* 19479 and 19514 illustrate this and the latter further deviates in having unusually small spikelets only 4–5 mm long. Some plants have well developed nearly horizontal beards on otherwise nearly glabrous joints. Very long, conspicuously hairy spikelets up to 11 mm long are found on *Blake* 13736, (which also has long leaf-blades up to 10 cm long or more, some rather more than 2·5 times the length of the sheath) and up to 10 mm on *Blake* 13603 and *McKee* 9198. A few collections such as *Vickery* NSW 12425 have some terminal peduncles extraordinarily long, up to 14 cm long, with their spatheoles also very long, convolute and sometimes with a more or less developed blade. The shape of the wing of the lower glume of the sessile spikelet varies a little in breadth and shape and this affects the outline of the spikelet. The curvature of the keel-nerves in the upper part is sometimes rather abrupt in other plants more gradual.

The species is constantly annual, but sometimes plants produce new basal shoots after the first-formed culms begin to flower, simulating innovation shoots though they will flower later in the season if allowed to do so. The type of *A. obliquiberbis* has these apparent innovation shoots which misled Hackel to describe the species as perennial. *Blake* 4824 and *Winders* 14 resemble the type material of both *A. fragilis* and *A. obliquiberbis* without exactly matching either or one another.

2. Schizachyrium perplexum S. T. Blake; species nova, affinis *S. fragili* (R. Br.) A. Camus et *S. pachyarthro* C. A. Gardner, ab hic racemis articulis spiculisque brevioribus angustioribusque et columna aristae breviore, ab illo spiculis sessilibus multo minoribus aristis tamen longioribus earum columna valde exserta articulis laxe pilosis praecipue differt. Typus: Queensland, Mt. Mulligan. *Pedler* 6 (BRI. 047910).

Gramen annuum parvum gracile ramosissimum. Culmi ± fasciculati usque ad 20 cm longi, ± 0·4 mm crassi, 5–8-nodi e nodis fere omnibus ramosi ramis usque 6-nis, internodiis margine sulcato infra nodis appresse pilosis. Foliorum vaginae carina superiore scaberulae; ligulae ± 0·7–0·8 mm longae; laminae basin versus paulo angustatae, apicem anguste subobtusum versus angustatae, ± conduplicatae, ± asperulae, carina marginibusque scaberulae, 1·7–2·7 cm longae, 1–1·5 mm latae (explanatae), vagina 1·5–2·5-ies longiores. Spatheolae cymbiformes usque planae, 1·8–3·2 cm longae, 2–3·5 mm latae, asperulae. Pedunculi 2–4·5 mm longi. Racemi 3–5-articulati, 1·3–1·8 cm longi, 0·7–0·9 mm crassi, spatheola breviores. Articuli pedicellique nec crassi nec graciles, pilosi pilis diffusis vel marginalibus; articuli basi 0·2 mm lati ad apicem obliquum 2-dentatum crenulatum 0·6 mm latum sensim incrassati, inferne diffuse pilosi; pedicelli oblique obovato-lineares, basi 0·1–0·2 mm lati sursum usque 0·3 mm lati, margine interiore inferiore dense ciliati, margine exteriore inferiore pilosi vel glabri. Spicula sessilis a dorso compressa, ± elliptica, fere acuta, 3·5–4·5 mm longa 0·6–0·7 mm lata, 5–7-ies longiores quam latiores; callus 0·3–0·4 mm longus antice haud verticaliter sulcatus, pilis ± 2 mm longis barbatus, ejus cicatrix subcircularis vel circulari-ovata, 0·25–0·3 mm longa, 0·25 usque fere 0·3 mm lata. Gluma inferior omnino 2-carinata, fere omnino alata, ala ubi latissima ab apice clare distante 0·15–0·2 mm lata infra medium ala angusta incrassata, flexuris usque ± 0·15 mm latis inter se clare distantibus, dorso convexa nervis intracarinalibus circa 3 percursa, pilis usque ± 3·5 mm longis longe pilosa. Gluma superior anguste obtusa 1-nervis, circa ⅔ longitudinis carinata, carina haud marginata minime scaberula. Lemma inferum circiter ¾ glumarum aequilongum. Lemma superum profunde bifidum; arista

16–22 mm longa ejus columna 6–7 mm longa per spatium 3–5 mm exsertum. Antherae 0·4 mm longum. Caryopsis anguste fere elliptica, subacuta, compressa, 1·6–2·2 mm longa, 0·55–0·65 mm lata, 0·3–0·4 mm crassa; embryo dimidium longitudinem caryopseos exacte adaequans, haud turgidus, haud trigonus. Spicula pedicellata persistens continuationem pedicelli simulans ad glumam parvam aristatam redacta, 0·6–0·7 mm longa; arista 2–16 mm longa. Figg.

Culms up to 20 cm long, about 0·4 mm thick, 5–8-noded, branched from about all the nodes, the branches up to about 6 together, the internodes ± appressed pilose on the channelled edge below the nodes. Leaf-sheaths scaberulous upwards on the keel; ligule about 0·7–0·8 mm long; blades little narrowed to base, narrowed towards the narrowly subobtuse tip, ± folded, ± asperulous with scaberulous keel and margins, 1·7–2·7 cm long, 1–1·5 mm wide when flattened, 1·5–2·5 times as long as the sheath. Spatheoles boat-shaped to flat, 1·8–3·2 cm long, 2–3·5 mm wide, asperulous. Peduncles 2–4·5 mm long. Racemes 3–5-jointed, 1·3–1·8 cm long, 0·7–0·9 mm thick, shorter than the spatheole. Joints and pedicels neither stout nor slender, without definite hair pattern. Joints 0·2 mm wide at base, gradually widened upwards to the oblique 2-toothed crenulate tip 0·6 mm wide, diffusely hairy downwards. Pedicels 0·1–0·2 mm wide at base, obliquely obovate-linear up to 0·3 mm wide in upper part, densely ciliate along inner side on lowest part, hairy in the lower part on the outer margin or glabrous. Sessile spikelet dorsally compressed, ± elliptic, about acute, 3·5–4·5 mm long, 0·6–0·7 mm wide, 5–7 times as long as wide; callus 0·3–0·4 mm long, not longitudinally furrowed in front, bearded with hairs ± 2 mm long; callus-scar subcircular to circular-ovate, 0·25–0·3 mm long, 0·25 to nearly 0·3 mm wide. Lower glume 2-keeled throughout, winged almost throughout, the wing widest well below the tip 0·15–0·2 mm wide, narrow and thickened below the middle, flaps up to about 0·15 mm wide, well separated; back convex with about 3 fine intracarinal nerves, long hairy with hairs up to about 3·5 mm long. Upper glume narrowly obtuse, 1-nerved keeled for about ⅔ of its length, keel not marginate, slightly scaberulous. Lower lemma about ¾ as long as the glumes. Upper lemma with an awn 16–21 mm long, the column 6–7-mm long, exserted by 3–5 mm. Anthers 0·4 mm long. Grain narrowly about elliptic, subacute, compressed, 1·6–2·2 mm long, 0·55–0·65 mm wide, 0·3–0·4 mm thick, embryo exactly half the length, not turgid, not trigonous. Pedicelled spikelet 0·6–0·7 mm long; awn 2–16 mm long. Figs. 1B, 3.

QUEENSLAND.—Burke District: Croydon, in open depressions on whitish sand, about 105 m, May 1935, *Blake* 9089A; Cloncurry, depressions at base of hills, 180–210 m, June 1934, *Blake* 6385. Cook District: Mt Mulligan, Apr 1939, *Pedler* 6; Etheridge R., *Armit* 685. Gregory North District: Tranby, approx. 22° 40′ S, 142° 25′ E, on rugged sandstone hillsides among *Triodia*, 165–210 m, May 1936, *Blake* 11434.

The acute winged spikelets resemble those of *S. fragile* more than any other species but they are much smaller; there is also resemblance in the form of the joints and the pedicels but none in their indumentum or in the general habit.

It also resembles some dwarf plants of *S. pachyarthron* in habit and indumentum but has longer ligules, shorter spatheoles, and smaller narrower racemes with narrower joints and pedicels and smaller relatively narrower more elliptic sessile spikelets. The habit resembles that of *S. occultum* and *S. crinizonatum*, the indumentum of the raceme is not unlike that of the former, but the winged, dorsally compressed elliptic sessile spikelet is very different from both. *Pedler* 6 is a good sheet but *Blake* 9089A is a single small overmature tuft found mixed with *S. pseudeulalia*. The possibility that the two collections represent a hybrid cannot be overlooked, but the only possible parents appear to be *S. fragile* and *S. pseudeulalia*; however, both these are usually cleistogamous and in any case such a cross would be expected to produce plants of a different habit with larger spikelets and some trace of the characteristic oblique beard of *S. fragile* on the joint. *Blake* 11434 is from a locality well distant from any known locality for either of these.

3. Schizachyrium pachyarthron C. A. Gardner, Fl. W. Aust. 1:336, pl. XCVIII, fig. A, (1952). Type: Western Australia, Camden Sound, Port George IV, *Holmes* (PERTH, holo; BRI).

Culms up to 1 m long, usually much less, the longer ones spreading, 0·5–2 mm thick, 5–13-noded, glabrous and smooth except for the ciliate or bearded upper part of the uppermost internodes, branches mostly solitary or 2–3-nate. Leaf-sheaths sometimes ± scaberulous on back and sides as well as the hyaline margins, glabrous or the upper ones also minutely puberulous at and near the nodes; ligule 0·2–0·6 mm long; blades slightly narrowed to the base, narrower than the sheath, gradually narrowed to a narrowly obtuse tip, usually folded, ± scaberulous on the margins and keel especially towards the tip and base, sometimes also on the other nerves, pubescent on upper surface near the base, ciliate about the base with fine hairs (1·5–) 2–3 mm long without a tuberculate base, wearing away with age, 1·5–10 cm long, 0·8–3 mm wide, 1·5–3 times as long as the sheath. Spatheoles boat-shaped or at length flat, glabrous or somewhat pubescent at base, smooth or the hyaline margins ± scaberulous, 2·5–6 (–7) cm long, 4–6·5 mm wide when flattened. Peduncles mostly 4–8 mm long or the terminal ones much elongated and longer than the spatheoles, glabrous. Racemes 6–10-jointed, 3–5 cm long, about 1·5–2 mm thick. Joints and pedicels about equal to or a little exceeding the sessile spikelet, the joint sometimes up to 0·5 mm longer than the pedicel; joints narrowly cuneate in outline, about parallel-sided upwards, (0·2–) 0·3–0·6 mm wide at the base, 0·15–1·3 mm wide at the slightly oblique 2-lobed tip, nearly equally thick, densely long ciliate in the lower part or throughout, densely pilose on the back in the lower part, pubescent or glabrous upwards, sometimes with a line of long hairs from margin to margin below the tip, sometimes shortly pilose on the inner face, sometimes the whole joint glabrous; pedicels very narrowly oblong or very narrowly obovate, 0·4–0·9 mm wide, ± cuneate at base, and there 0·25–0·5 mm wide, subtrigonous upwards, densely long ciliate throughout one edge and usually at least the upper part of the other edge pubescent over part or most of the back and sometimes on the inner surface. Sessile spikelet dorsally compressed, the upper glume hidden above the middle by the joint and pedicel, about oblong or elliptic-oblong or narrowly subobovate-oblong, winged, broadly very obtuse or subtruncate to subacute in outline, ± emarginate, the edges tightly appressed to the edges of joint and pedicel below, the wings usually overlapping these above, 5–8 mm long, 1·3–1·6 mm wide, ± 4–5 times as long as wide; callus obtuse, 0·4–1·0 mm long, not longitudinally furrowed in front, bearded also in front, the longer hairs about 1 mm long; callus-scar nearly vertical, circular or broadly elliptic or very broadly ovate or obovate, 0·35–0·6 mm long, 0·3–0·6 mm wide. Lower glume coriaceous, acutely 2-keeled to base or almost to base, keels winged throughout, rib-like below and there smooth, up to 0·15–0·2 mm wide at base, hyaline and up to 0·4–0·6 mm wide near the subtruncate but ± irregular and sometimes pubescent tip, with scaberulous margins sometimes ciliate at tip, flaps narrow, well distant, glabrous or pubescent, incurved below, back convex, ± flattened upwards, finely 5-nerved between the keels usually with some cross-veins, densely pilose with hairs up to 4·5 mm long at least towards the base, or the whole glabrous. Upper glume often winged or marginate upwards on the keel or at least with a prominent tooth, elsewhere pubescent to about glabrous. Lower lemma about as long to distinctly shorter than the glumes, 2-nerved. Upper lemma a little shorter than the glumes; awn 19–30 mm long, column 8·5–11 mm long exserted by 3–6 mm. Anthers ± 0·5–0·7 mm long. Grain narrowly suboblong or narrowly elliptic to somewhat ovate, obtuse, compressed biconvex with broadly rounded edges, 2·3–3·5 mm long, 0·7–1 mm wide, 0·4–0·6 mm thick; embryo about ⅖–½ as long as the grain, not thicker than the endosperm, subtrigonous below. Pediceled spikelet 1·5–3 mm long, ciliate, sometimes also pubescent, awn 10–30 mm long or as short as 1 mm; upper glume sometimes present, rudimentary. Figs. 1C, 3.

WESTERN AUSTRALA.—Northern Province: Kunmunya Mission, Camden Sound, May 1943, *Holmes in hb. R. A. Black;* Merny's Ck, upper Glenelg R., Jul 1950, *Gardner* 9650 in part.

NORTHERN TERRITORY.—Darwin and Gulf District: Port Darwin, *Giles* 77; near Hayes Creek, 13° 35½′ S, 131° 28′ E, on damp sandy soil carrying *Banksia, Acacia, Verticordia, Pandanus,* etc., ± 107 m, Jun 1946, *Blake* 16189; 24 miles NW of Katherine on Darwin road, disturbed stony hard soil in open *Eucalyptus* forest, ± 180 m, Jun 1946, *Blake* 16033, 16034; near headwaters of Flora R., 54 miles SW of "Dorisvale", May 1952, *Lazarides* 2812; [near, ± ESE of, Brocks Creek] on grey gravelly sand, Mar 1964, *Adams* 921; Hemple Bay, Groote Eylandt, in *Melaleuca leucadendron* stand, Apr 1948, *Specht* 319 in part; near McArthur R., 16° 38′ S, 135° 51′ E, among boulders on rugged quartzite ridge, ± 85 m, May 1947, *Blake* 17765.

QUEENSLAND.—Burke District: towards Croydon from "Esmeralda" (13 miles), sandy seepage slope dominated by *Melaleuca viridiflora,* Jul 1954, *Blake* 19617B. Cook District: Thursday I., Jun 1897, *Bailey,* Jun 1936, *Hockings*; Weipa, May 1967, *Coaldrake* and Apr 1968, *Coaldrake;* Endeavour R. (?), first voyage of the "Mermaid", [in 1819], *Cunningham;* Cooktown, damp sandy ground in *Eucalyptus* forest, May 1962, *Blake* 21808; Cooktown, on Grassy Hill, among granite boulders, with scattered to clustered trees, May 1962, *Blake* 21845; Mareeba, sandy soil, in 1950, *Straughan;* headwaters of Murphys Creek, near Mareeba, Apr 1961, *Goodall* 67; Walsh's Pyramid, lower western slope, 60–135 m, open rock slopes in and around living or dead *Micraira* mats, May 1962, *Blake* 21770; W of Einasleigh, upper slopes of Newcastle Range, scrubby *Eucalyptus* forest, reddish stony sandy soil, 670 m, Jul 1964, *Blake* 19516. North Kennedy District: half-way between Townsville and Rollingstone in chiefly *Melaleuca* forest on pale hard soil, ± 10 m, Apr 1945, *Blake & Webb* 15771; Bowen-Ayr road, ± 11 miles from Bowen, sandy edge of small stream, Sep 1950, *Blake* 18602. Port Curtis District: between Broad Sound and Shoalwater Bay on Torilla Station, approx. 22° 31′ S, 150° 6′ E, in *Melaleuca* scrub, Apr 1945, *Blake & Webb* 15681; Facing I., Farmers Point, mixed open forest on sand, Mar 1966, *Blake & Boyland* 22538.

S. pachyarthron can be readily distinguished by the suboblong winged sessile spikelet usually very obtuse because the wing is widened upward to the top and tends to embrace the joint and pedicel. It is the only Australian species with a conspicuously 2-nerved lower palea or with cross veins in the lower glume. The column of the awn is also relatively longer than in other species, up to nearly twice the length of the spikelet. *Blake* 21808 includes many youngish plants with mostly solitary and simple culms with well exserted racemes and spatheoles often with short blades and at first sight these look very different but a few plants have branched culms with most racemes ± included; Hockings's copious collection includes similar plants with all intermediates between this state and freely branched plants with all racemes at least partly included as well as some plants with the lower glume of the sessile spikelet nearly glabrous. *Blake* 16034 has the wing of the lower glume of the sessile spikelet not much widened upward so that the spikelet is nearly acute and more nearly elliptic.

4. Schizachyrium pseudeulalia (Hosokawa) S. T. Blake, Proc. Roy. Soc. Qd 80:77 (1969). Based on *Microstegium pseudeulalia.*

Microstegium pseudeulalia Hosokawa, Trans. Nat. Hist. Soc. Formosa 28:151 (1938). Type: Caroline Is., Palau, *Hosokawa 9189* (A, iso).

Andropogon fragilis R. Br. var. *luzoniensis* Hack. Philipp. J. Sci. 1 (Suppl.): 267 (1906). Type: Two syntypes from the Philippines, but the diagnosis refers strictly only to *Merrill 4386* (K, W).

Andropogon fragilis R. Br. var. *malayanus* Merr. Enum. Philipp. Pl. 1:45 (1922). Type: Five syntypes, four from Philippines, one from New Guinea.

Andropogon cryptopodus Ohwi, Bot. Mag. Tokyo 56:10 (1942). Type: West New Guinea, Mori towards Lake Angi, *Kanehira & Hatusima 13390* (A, iso).

Andropogon brevifolius Sw. var. *cryptopodus* (Ohwi) Reeder, J. Arnold Arb. 29:363 (1948). Based on *A. cryptopodus.*

Schizachyrium fragile (R. Br.) A. Camus var. *luzoniense* (Hack.) P. Jansen, Reinwardtia 2:338 (1953). Based on *Andropogon fragilis* var. *luzoniensis.*

Schizachyrium fragile (R. Br.) A. Camus var. *malayanum* (Merr.) P. Jansen, Reinwardtia 2:337 (1953). Based on *Andropogon fragilis* var. *malayanus.*

Culms up to 90 cm long, usually much less, the longer ones ± spreading, sometimes tending to root at the lower nodes after shedding the lower leaves, 0·35–0·2 mm thick, mostly 7–12-noded (as few as 5-noded in dwarf plants), the internodes sometimes scaberulous on both margins even below and the uppermost sometimes sparsely pilose on the channelled edge, branches solitary or up to 8 together, some of these sometimes 2–3-noded and rebranched. Leaf-sheaths smooth or scaberulous on the sides, scabrous or scabrous-ciliate on the keel in the upper part; collar shortly pubescent to glabrous; ligule 0·2–1·3 mm long, often glabrous on the back; blades linear, rounded at the base, much constricted to the sheath and about as wide or wider than it, narrowed towards the end to a narrowly obtuse to ± acute tip, more acute in the upper leaves, usually folded but sometimes flat, scaberulous to ± scabrous on margin and keel, less so about the middle of the latter, scabrous to stiffly ciliate on and near the rounded base and on the keel about the collar, pubescent and also loosely pilose behind the ligule, 1·5–9 cm long, 0·8–5·5 mm wide, 1·2–2, mostly 1·3–1·7 times as long as the sheath. Spatheoles persistently ± boat-shaped, ± involute towards the tip, 2–4 mm wide when flattened, 2–4·5 cm long, nearly smooth. Peduncle 3–20 mm long, mostly $\frac{1}{10}$–$\frac{2}{3}$ as long as the spatheole sometimes nearly as long to longer in the terminal raceme of main culms, glabrous and smooth. Racemes 5–10-jointed, 1·5–5 cm long, 0·6–1·4 mm thick. Joints and pedicels ± contiguous in the upper part, scaberulous to ciliate on the inner or both margins usually in the upper part, elsewhere smooth and glabrous or also long hairy on the back in the lower part; joints ± clavate, about 0·5 mm wide at the base, much widened upwards sometimes nearly from the base, often ± parallel-edged in the upper part, tip oblique, 2-toothed, scaberulous, 0·6–1·1 mm wide; pedicel very narrowly obliquely obovate, attenuate below, 0·2–0·3 mm wide at base, 0·4–0·8 mm wide above the middle. Sessile spikelets dorsally compressed, the upper glume partly hidden (from a little above the middle) by the contiguous joint and pedicel, narrowly to very narrowly ovate or very narrowly ovate-oblong, ± asymmetrically ± acuminate, acute except for the bifid tip, 4–8 mm long, (0·6–) 0·7–1 mm wide, 5·5–8 times as long as wide, as wide as or wider than the joints (wider than the thickness of the joints); callus about 0·5–0·7 mm long with hairs up to 1·2–2·5 mm long; callus-scar oblique in profile, mostly as long or somewhat longer rarely somewhat shorter than wide, subcircular to somewhat ovate or the upper edge concave, 0·25–0·6 mm long, 0·25–0·6 mm wide. Lower glume thinly coriaceous, 2-keeled to base, the keels not marginate but acute and scaberulous above more rounded near base; flaps narrow, sharply inflexed above the middle, well distant; back flattened above, convex below, slenderly 3–5-nerved between the keels, scaberulous or verruculose-scabrous, glabrous or the lower part densely pilose. Upper glume as long or slightly longer, keel not winged, scabrous, sometimes shortly excurrent, smooth or asperulous on the sides. Lower lemma about $\frac{3}{5}$–$\frac{4}{5}$ as long as the glumes. Upper lemma with an awn 11–30 mm long, the column 4·5–9 mm long. Anthers 0·4–1 mm long. Grain narrowly ovate-oblong-elliptic, narrowly obtuse, compressed, unequally biconvex, slightly curved or straight in side view, 2–3 mm long, 0·4–0·6 mm wide, 0·3–0·4 mm thick, embryo scarcely at all thicker than the endosperm, not trigonous, half or nearly half as long as the grain. Pedicelled spikelet 1–1·7 mm long with an awn 3–14 mm long. Figs. 1D, 4.

WESTERN AUSTRALIA.—Northern Province: Base of Precipice Range, May 1905, *Fitzgerald* 868; Hall's Creek, schistose rocks on banks of watercourse, May 1944, *Gardner* 7150; Ord R., Apr—May 1945, *K. M. Durack*.

NORTHERN TERRITORY.—Darwin and Gulf District: Point Charles, western side of Darwin Harbour, *Mair* 214B; Port Darwin, *Schultz* 129 (partly), 131, 206 (partly), 240; Beatrice Hill, 40 miles SE. of Darwin, Mar 1961, *Chippendale* NT 7975. Victoria River District: near (S. of) "Dunmarra" in heavily grassed very open parkland of *Eucalyptus microtheca,* hard grey soil, ± 240 m, Jun 1946, *Blake* 16023; upper Victoria R., *Mueller*. Barkly Tableland District: about 35 miles N of Anthony Lagoon, light yellow-grey hard soil dominated by *Aristida latifolia,* 233 m, May 1947, *Blake* 17790.

QUEENSLAND.—Burke District: Croydon, in open depressions on whitish sand ± 105 m, May 1935, *Blake* 9089; "Yelvertoft" between Mt. Isa and Camooweal, on mud, Apr 1935, *Blake* 8622; near source of Poison Creek about 90 miles N of Hughenden, in *Eucalyptus-Callitris* forest on compact sand, 780 m, Apr 1935, *Blake* 8492. Cook District: Cooktown, *Eucalyptus* forest among granite rocks, May 1962, *Blake* 21805, and on Grassy Hill, among granite boulders, with scattered to clustered trees, May 1962, *Blake* 21845A; on "Wrotham Park", about 50 miles NW of Mungana, on gently undulating plain with *Terminalia* etc., on grey heavy clay, Apr 1938, *Blake* 13660; Chillagoe, on damp sandy shaded creek bank, 345 m, Mar 1938, *Blake* 13545 and on granite hill slopes ± 435 m, Apr 1938, *Blake* 13634; Mt Molloy, on hard clay soils, 360 m, Apr 1932, *Brass* 2482 and on rocks in open *Eucalyptus* forest, 400 m, Apr 1962, *McKee* 9112; Gorge Creek, 10 miles W of Mareeba, 420 m, Apr 1962, *McKee* 9184; Mareeba in dried out mud, 120 m, Apr 1962, *McKee* 9080; Mareeba in mixed open forest on yellowish brown fine gravelly loam, 390 m, Jun 1935, *Blake* 9489, and in gently undulating *Eucalyptus* forest on light grey sand, ± 420 m, Mar 1938, *Blake* 13388; Boyle Ck, NW of Mareeba, in sand among rocks, 600 m, Apr 1962, *McKee* 9152 (in part); headwaters of Murphys Creek, SW of Mareeba, Apr 1961, *Goodall* 64; Mt Surprise, in nearly open grassland on hard cracky somewhat greenish grey soil, chiefly in depressions, common, Aug 1943, *Blake* 15108; around Tolga forest country, Apr 1927, *Pollock;* Stannary Hills, May 1909, *T. L. Bancroft;* Irvinebank, Apr 1903, *Bennett;* Basilisk Range, South Johnstone, Jun 1938, *Langdon;* "Forest Home" on poor sandstone flats, Sep 1950, *Simonett;* W of Einasleigh, upper slopes of Newcastle Range, scrubby *Eucalyptus* forest, reddish stony sandy soil, 670 m, Jul 1954, *Blake* 19515; crest of western scarp of Great Dividing Range, 12 miles ± E of "The Lynd", in mixed open forest on sandstone ridge, 540 m, Jul 1954, *Blake* 19480. North Kennedy District: Ravenshoe, damp hillsides in *Eucalyptus* forest on loam, 900 m, Jun 1935, *Blake* 9573; 9 miles from Townsville towards Rollingstone, in low *Melaleuca* forest on ill-drained hard light grey soil ± 10 m, Apr 1945, *Blake & Webb* 15758; Townsville, hillsides in *Eucalptus* forest on sandy soil, alt. up to 90 m, Mar 1938, *Blake* 13338; Cleveden, moderately common on rocky hillsides, Mar. 1933, *White* 8880; NW of Pentland near (ESE of) "Lolworth", *Eucalyptus* forest, sandy soil, ± 633 m, Jul 1954, *Blake* 19356, *Lazarides* 4591; Pentland, sandy creek bank in partial shade, 390 m, Jun 1934, *Blake* 6040; NW b W of Charters Towers near "Maryvale" homestead, dark grey hard clay soil, scattered, Jul 1954, *Blake* 19409, *Lazarides* 4625; Charters Towers, open granite hillsides, 300-360 m, Jun 1936, *Blake* 11682; "Victoria Downs" S of Charters Towers, Apr (?) 1930, *Rosendall;* Ravenswood, sandy creek bank, ± 270 m, Mar 1943, *Blake* 14883; Bowen, in *Eucalyptus* forest, side of gully, hard brown soil, Sep 1950, *Blake* 18572; NW of junction of Burdekin and Bowen Rivers, 20° 20′ S, 147° 15′ E, in sand in dwarf forest of *Melaleuca*, Oct 1950, *Blake* 18676; Hayman I., Jun 1934, common on hillsides in open forest, *White* 10202; Hook I., summit of Hook Peak, Jun 1937, *Goy* 155. Port Curtis District: "Raspberry Vale", 22° 34½′ S, 150° 23′ E, in *Melaleuca* forest, Apr 1945, *Blake & Webb* 15559; near Rockhampton, common, *Dietrich* 338; Curtis I., N of Southend, mixed open low forest on light grey fine sandy soil, Mar 1966, *Blake & Boyland* 22566; Rosedale, Jun 1931, *Dovey* 445; Rosedale, in moist sand in creek bed, Apr 1933, *Dovey* 453. Wide Bay District: Moorland, near Bundaberg, in railway enclosure through wallum scrub, Apr 1936, *Blake* 11339.

S. pseudeulalia is also known from Java, Philippines, Celebes, Timor, Caroline Islands and New Guinea. The detailed distribution is given in my earlier paper.

S. pseudeulalia is most like *S. brevifolium* (Sw.) Nees ex Bűse, a species originally described from Jamaica and widely distributed in tropical North and South America, Africa, India to Japan and through Malesia to New Guinea. The ranges of the two overlap in Malesia. *S. brevifolium* has relatively shorter very blunt leaf-blades mostly from about as long up to half as long again as the sheaths, more slender racemes all or most of which are exserted or nearly exserted from the smaller ± convolute spatheoles (peduncles nearly as long as to longer than the spatheoles), smaller scarcely acuminate sessile spikelets mostly 2–4 mm long with smaller callus (0·15–0·25 mm long), more nearly transverse callus-scar commonly a little shorter than wide and sometimes ± reniform, lower glume incurved from about the middle, upper glume visible for the greater part of its length between the usually more slender joint and pedicel, and shorter awn (7–11 mm long) that is sometimes absent; it is also usually more slender with culms about 0·5–1·1 mm thick on well grown plants. Some of the variations of *S. pseudeulalia* parallel those of *S. brevifolium*. As in the latter, the racemes are commonly glabrous except for the callus, but plants with joints, pedicels and lower glume of the sessile spikelet sparsely to densely hairy are frequent, sometimes growing with plants with these parts glabrous. Some collections have ciliate pedicels and glabrous glumes. Sessile spikelets longer than 6 mm are uncommon, but long spikelets are characteristic for *Blake* 8622 and 13634 with glabrous glumes, joints and pedicels and *Blake* 13388 with hairy glumes, joints and pedicels. *Blake* 8622 has the culms scabrous on the edges nearly throughout and the keels of both glumes distinctly excurrent.

Bentham, Fl. Aust. 7:529 (1878), identified the collections of Schultz and Mueller with *Andropogon fragilis* R. Br. and this identification was accepted by Hackel, Monogr. Andropog. 364 (1889), where *A. fragilis* was treated as a variety of *A. brevifolius*. Hackel's concept seems to have been based on a

Schultz specimen without number in his herbarium now in hb. Vienna; he did not see Brown's type and it is doubtful if he saw Mueller's collection. Later, without comment, he accepted *A. fragilis* as a distinct species and both he and Merrill described varieties from the Philippines. Merrill described *A. fragilis* var. *malayanus* as having spikelets and pedicels entirely glabrous but of the syntypes (isosyntypes) seen, only *Merrill* 8012 and *King* 1002 fully agree; on *Merrill Phil. Pl. no.* 156 and *Loher* 1864 the pedicels are ciliate and I have not seen *McGregor* BS. 19977. *A. fragilis* var. *luzoniensis* was described with two syntypes both in hb. Hackel, but Hackel's diagnosis (glume of sessile spikelet hirtellous, pedicel glabrous) strictly refers only to *Merrill* 4386, for in *Merrill* 4468 the pedicel is ciliate on one margin as noted by Hackel on the label. The material seen of *Merrill* 4468 (W, K) is not entirely satisfactory and the somewhat purplish grain with a bulging embryo trigonous in the lower part may be immature but does not entirely match the grain of any other specimen examined.

Andropogon cryptopodus was described as having a creeping base; the base on the isotype resembles that of *Merrill* 8012 and to a lesser extent other collections from the Philippines and Australia.

5. Schizachyrium crinizonatum S. T. Blake; species nova ob articulos pedicellosque (pro ratione graciles) supra medium zona transversa angusta pilorum longorum eleganter barbatos alibi glabros distinctissima; quoad spicula sessilis a latere compressa callo acuto *S. exile* (Hochst.) Pilger (speciem extraaustralianam) et *S. occultum* S. T. Blake revocat sed ad eis praeter barbam racemis articulis pedicellis multo gracilioribus discrepat. Typus: Northern Territory prope Katherine, *Blake* 17477 (BRI. 106885; isotypi distribuendi).

Gramen annuum gracile, ramosum. Culmi plerumque fasciculati usque 40 cm longi, 0·35–0·6 mm crassi, 6–9-nodes internodiis superioribus sub nodis interdum pubescentibus ceterum glabri. Foliorum vaginae prope margines et in carina sursum ± scaberulae vel omnino laeves; ligulae 0·3–0·5 mm longae; laminae anguste lineares obtusissimae basin versus angustatae, conduplicatae vel ± convolutae, apicem basinque versus marginibus carinaque saepe scaberulae, supra etiam ± scaberulae, prope basin haud ciliatum pubescentes, post ligulam pilos longos paucos gerentes, 2–5·5 cm longae, 0·9–1·5 mm latae pro more vaginae aequilongae usque duplo quam ea longiores et quam ea multo angustiores. Spatheolae primo convolutae tandem cymbiformes vel planae, sursum ± asperulae, saepius 3–4 cm longae et (explanatae) 2–4 mm latae. Pendunculi 2·5–4 mm longi. Racemi 4–5-articulati, 2–2·5 cm longi, ± 0·45–0·55 mm crassi. Articuli pedicellique tenues sursum haud contigui, laeves, supra medium barbam longam densissimam horizontalem vel fere horizontalem rectam vel curvam gerentes; articuli sursum praecipue supra barbam dilatati apice obliquo irregulariter crenulati ± 0·5 mm lati; pedicelli compressi sublineares sursum sensim dilatati, supra barbam 0·3 mm lati. Spicula sessilis a latere compressa (gluma superiore inter articulam pedicellumque protrusa), angustissime ovata apice ipso bidentato excepto sensim acuta, 4·5–6·7 mm longa 0·35–0·55 mm lata, 9–13-ies longior quam latior; callus acutus curvus 0·7–1·3 mm longus, pilis usque ad 1·2 mm longis basi barbatus; antice sulco barbaque medialibus longitudinalibus praeditus; cicatrix calli anguste obovata vel fere elliptica, fere erecta, 0·35–0·6 mm longa 0·15–0·2 mm lata. Gluma inferior

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chartacea dimidio superiore acute bicarinata carinis haud marginata minute scaberula infra medium valde incurva, flexuris usque ad 0·1 mm latis sese partim tangentibus vel fere tangentibus, dorso valde convexa, glabra, intra carinis tenuissime vel obscure 2-nervi. Gluma superior 1-nervis, parte superiore carinata carina vix marginata scaberula ex apice ± 3-dentata vix excurrente, lateribus laevis glabraque marginibus ciliata. Lemma inferum ¾ glumarum aequans. Lemma superum infero subaequilongum infra aristam induratum profunde incurvatum, bifidum lobis glabrum; arista 16–23 mm longa ejus columna 5–8·5 mm longa. Antherae circiter 0·5 mm longae. Caryopsis lineari-ovata, obtusa, praecipue supra embryonem compressa, 2·5–3·4 mm longa, 0·35–0·5 mm lata, 0·25–0·4 mm crassa; embryo endospermate paulo crassior, trigonus, quoad longitudino inter ⅓ et ½ caryopseos interstans. Spicula pedicellata persistens continuationem pedicelli simulans ad gluman parvam aristatam redacta, 0·9–1·2 mm longa; arista 5–8 mm longa.

Culms up to 40 cm long, 0·35–0·6 mm thick, 6–9-noded, upper internodes sometimes pubescent below the nodes. Leaf-sheaths somewhat scaberulous in the upper part on keel and near margins or at length entirely smooth; ligule 0·3–0·5 mm long; blades rather gradually narrowed to base, very obtuse, folded or ± convolute, ± scaberulous on margins and keel towards base and tip or nearly smooth, upper surface also minutely ± scaberulous, pubescent close to base which is not ciliate and with a few longer hairs behind the ligule, 2–5·5 cm long, 0·9–1·5 mm wide, mostly from about as long to about twice (up to 2·4 times) as long as, and much narrower than the sheath. Spatheoles at first convolute, finally boat-shaped or ± flat, ± asperulous upwards, (2·5–)3–4 cm long, 2–4 mm wide when flattened. Peduncles 2·5–4 mm long. Racemes 4–5-jointed, 2–2·5 cm long, about 0·45–0·55 mm thick. Joints and pedicels slender, not contiguous upwards, glabrous and smooth except for a very dense horizontal or nearly horizontal straight or curved beard above the middle, that of the pedicel often a little higher up than that of the joint, the hairs up to 3·5–6 mm long; joints about 0·2 mm wide at base, widened upwards especially above the beard to the oblique, irregularly crenulate tip about 0·5 mm wide; pedicels compressed, about 0·2 mm wide at base, sublinear, gradually widened upwards, 0·3 mm wide above the beard. Sessile spikelet laterally compressed with the upper glume jutting between joint and pedicel, very narrowly ovate, gradually acute except for the bifid tip, 4·5–6·7 mm long, 0·35–0·55 mm wide, 9–13 times as long as wide; callus acute, curved, 0·7–1·3 mm long, bearded at base with hairs up to 1·2 mm long and with a median longitudinal furrow and beard in front; callus scar ± narrowly ovate to almost (narrowly) elliptic, nearly erect, 0·35–0·6 mm long 0·15–0·2 mm wide. Lower glume chartaceous, sharply 2-keeled only in upper ½, much rounded below, keels not marginate, minutely scaberulous; flaps 0·1 mm wide or less, partly touching or nearly so; back very convex, glabrous with 2 very fine or obscure intra-carinal nerves. Upper glume shorter or longer, 1-nerved, keeled in upper part, the keel slightly marginate, scaberulous, scarcely excurrent from the somewhat 3-toothed tip, sides smooth and glabrous except for the ciliolate margins. Lower lemma about ¾ as long as the glumes. Upper lemma about as long, hardened and rounded below the awn, the lobes glabrous; awn 16–23 mm long, the column 5–8·5 mm long. Anthers about 0·5 mm long. Grain very narrowly ovate, narrowly obtuse, compressed especially above the embryo, 2·5–3·4 mm long, 0·35–0·5 mm wide,

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0·25–0·4 mm thick; embryo a little thicker than the endosperm, trigonous, between ⅓ and ½ as long as the grain. Pedicelled spikelet 0·8–2 mm long, glabrous; awn 9–23 mm long. Figs. 1F, 5.

WESTERN AUSTRALIA.—Northern Province: Merny's Ck., upper Glenelg R., Jul 1950, *Gardner* 9650 in part; foothills of Deception Range at base of rocks in seepages in sandy soil, Mar 1949, *Langfield* 79a; Spring Ck., Button's Gap, Apr 1958, *Burbidge* 5685.

NORTHERN TERRITORY.—Darwin and Gulf District: 24 miles NW of Katherine on Darwin Road, disturbed stony hard soil in open *Eucalyptus* forest, ± 180 m, Jun 1946, *Blake* 16032; near (NW of) Katherine, wet sandy margins of small stream, ± 150–160 m, Apr 1947, *Blake* 17477.

QUEENSLAND.—Cook District: near Chillagoe, in damper places in open forest on grey sandy soil, Apr 1938, *Blake* 13572. Burke District: towards Croydon from "Esmeralda" (13 miles), sandy seepage slope dominated by *Melaleuca viridiflora,* Jul 1954, *Blake* 19617A. North Kennedy District: 0·5–1·5 miles N of Yabalu, near Townsville, on *Melaleuca cunnighamii* flat, Oct 1942, *L. S. Smith* T.163.

S. crinizonatum differs from other species in the neat dense long ± horizontal beard above the middle of the slender joints and pedicels and the acute slender callus with an unusually narrow scar, and from most in the absence of long fine marginal hairs at the base of the leaf-blade; the laterally compressed sessile spikelet otherwise resembles that of *S. occultum* fairly closely, but the lower glume has somewhat narrower flaps sharply inflexed to about the middle instead of only in the upper third, and the upper glume is scarcely ciliate. Three of my collections are of plants that were growing in more or less close association with other species: 16032 with *S. pachyarthron*, 13572 with *S. fragile* and others, and 19617A with *S. fragile* and *S. dolosum*. *Gardner* 9650 has *S. pachyarthron* and *S. fragile* mixed with *S. crinizonatum*.

6. Schizachyrium occultum S. T. Blake; species nova, affinis *S. exili* (Hochst.) Pilger sed foliis obtusis, articulis pedicellisque crassioribus et spiculis pedicellatis reductis persistentibus praecipue differt. Typus: Queensland, Cooktown, *Blake* 21823 (BRI. 061525-6); isotypi distribuendi.

Gramen annum gracile ramosum. Culmi plerumque fasciculati pro more 10–30 cm alti 0·3–0·5 mm crassi, 8–12-nodes mox e nodis pluribus vel omnibus ramosi ramis saepe ramulosi, infra spatheolas barbati vel ciliati. Foliorum vaginae glabrae laevesque vel carina apicem versus scaberulae; ligulae 0·15–0·25 mm longae; laminae basi paulo constrictae sursum apicem rotundatum versus paulo angustatae, conduplicatae vel admodum convolutae saepe tortae, basi pilis tenuibus e tuberculis ortis longe ciliatae ceterum glabrae, marginibus et (parte prope medium excepta) carina scaberulae, 1·5–3·5 cm longae, 0·6–2 mm latae (explanatae) quam vaginae haud latiores sed saepius angustiores atque sesquies usque duplo longiores. Spatheolae cymbiformes tandem planae, glabrae laevesque, 1·5–3·7 cm longae, ± 3 mm latae. Pedunculi 2–4 mm longi glabri vel apice ± pilosi. Racemi 5–10-articulati, 1·2–2·7 cm longi, ± 1·5 mm crassi. Articuli et pedicelli spiculae sessili fere aequilongi, marginibus ambobus dense ciliato-barbati; articuli crassi inferne anguste cuneati sursum oblongi basi 0·5 mm lati apice obliquo 0·9–1·1 mm lati 0·5–0·7 mm

crassi, dorso inferne pubescentes; pedicelli anguste elliptici multo compressi cum spicula primo adspectu spiculas sessiles simulantes, dorso inferne pilosi basi 0·3 mm lati, medio vel prope medium 0·55–0·8 mm lati. Spicula sessilis a latere compressa inter articulum pedicellumque arcte inclusa crassitie pedicelli angustior, angustissime ovata sensim acuta, 3·75–5·1 mm longa, 0·35–0·5 mm lata, 9–13-ies longior quam latior; callus obtusus fere rectus, fronte verticaliter sulcatus, 0·45–0·65 mm longus, pilis usque ad 1 mm longis barbatus; cicatrix calli circiter elliptica usque paulo obovata, 0·3–0·4 mm longa, 0·25–0·3 mm lata. Gluma inferior chartacea solum tertia parte superiore acute bicarinata, inferne incurva, carinis scaberula haud marginata flexuris bene distantibus ± 0·15 mm latis, dorso inter carinas depressa inferne convexa, in majore parte dense pilosa, nervis intracarinalibus 2 inconspicuis praedita. Gluma superior acuta, mucronata, carina ± marginata longe ciliata, dorso inferne pilosa. Lemma inferum acutum, enerve, glumis fere aequilongum. Lemma superum ± ¾ glumarum aequilongum, glabrum, profunde bifidum; arista 9–13 mm longa, ejus columna 4–5 mm longa. Antherae 0·4 mm longae vel breviores. Caryopsis anguste lineari-ovata, superne crasse compresseque biconvexa, 2·6–3 mm longa, 0·4 mm lata, 0·3 mm crassa; embryo trigonus endospermate crassior et ± protuberans ± ⅓ caryopseos aequilongus. Spicula pedicellata persistens, continuationem pedicelli simulans ad glumam parvam ciliatam aristatam redacta 0·9–1·2 mm longa; arista 5–8 mm longa.

Culms very slender, mostly 10–30 cm high 0·3–0·5 mm thick, 8–12-noded, not much compressed, bearded or ciliate below the spatheoles, early branching from several or all nodes, sometimes rebranching, branches solitary or paired. Leaf-sheaths glabrous and smooth, or the keel somewhat scaberulous near the top; ligules 0·15–0·25 mm long; blades a little constricted at the base, slightly narrowed in upper part to a rounded tip, folded or somewhat convolute, often twisted, ciliate at the base with fine tubercle-based hairs 2–2·7 mm long otherwise glabrous, scaberulous along the margins and, except about the middle, the keel, 1·5–3·5 cm long, 0·6–2 mm wide when flattened and usually narrower than the sheaths, 1·5–2 times as long as the sheath. Spatheoles boat-shaped, at length flat, glabrous and smooth, 1·5–3·7 cm long, about 3 mm wide. Peduncles 2–4 mm long, glabrous or the tip ± pilose. Racemes 5–10-jointed, 1·2–2·7 cm long, ± 1·5 mm wide. Joints and pedicels almost as long as the sessile spikelet, densely long-ciliate on both margins; joints stout, 0·5 mm wide at base, narrowly cuneate below becoming oblong upwards, 0·9–1·1 mm wide at the oblique tip and 0·5–0·7 mm thick, pubescent downwards on the back; pedicels narrowly elliptic, much compressed, each with its spikelet resembling at first sight a sessile spikelet, pilose on the back below, 0·3 mm wide at base 0·55–0·8 mm wide about the middle. Sessile spikelet laterally compressed, wedged in between the joint and pedicel, narrower than the thickness of the joint, very narrowly ovate, gradually acute, 3·75–5·1 mm long, 0·35–0·5 mm wide, 9–13 times as long as wide; callus obtuse, about straight, vertically furrowed in front, 0·45–0·65 mm long, bearded with hairs up to 1 mm long; callus-scar about elliptic to slightly obovate, 0·3–0·4 mm long, 0·25–0·3 mm wide. Lower glume chartaceous, sharply 2-keeled only in the top ⅓, incurved below, keels scaberulous not marginate, flaps well distant, about 0·15 mm wide, back depressed between the keels, convex below, densely pilose over the greater part, with 2 very faint intracarinal nerves. Upper glume acute, mucronate, long ciliate on the ± marginate keel, hairy on the back below. Lower lemma very nearly as long as

the glumes, nerveless. Upper lemma about $\frac{3}{4}$ as long as the glumes, glabrous; awn 9–13 mm long, column 4–5 mm long. Anthers 0·4 mm long or less. Grain very narrowly ovate, thickly and compressedly biconvex above, 2·6–3 mm long, 0·4 mm wide, 0·3 mm thick; embryo trigonous, thicker than the endosperm and ± bulging, about $\frac{1}{3}$ as long as the grain. Pedicelled spikelet 0·9–1·2 mm long, ciliate; awn 5–8 mm long. Figs. 1E, 5.

QUEENSLAND.—Cook District: Coen, in short grass pockets, *McLennan;* Endeavour R., *Shirley;* Cooktown, damp sandy ground in *Eucalyptus* forest, May 1962, *Blake* 21823, in seepages in open forest, ± 30 m Jul 1943, *Blake* 15062, and on Grassy Hill, among granite boulders, with scattered to clustered trees, May 1962, *Blake* 21844A; S. of Cooktown, Annan Gorge, *Eucalyptus* forest, May 1970, *Blake, Correll & Stearn* 23404; near Chillagoe in damper places in open forest on grey sandy soil, Apr 1938, *Blake* 13572B; Mt Mulligan, Apr 1939, *Pedler* 18; Mt Molloy, alluvial flats, 360 m, Apr 1932, *Brass* 2394, and on dry hillsides, Apr 1932, *Brass* 2160A; Boyle Creek, NW of Mareeba, in sand among rocks, 600 m, Apr 1962, *McKee* 9152 in part; near Mareeba in gently undulating *Eucalyptus* forest on light grey sand, about 420 m, Mar 1938, *Blake* 13388A; half-way between Atherton and Herberton, in ranges N of road, Aug 1948, *L. S. Smith* 3745A. North Kennedy District: Ravenshoe, damp hillsides in *Eucalyptus* forest on loam, 900 m, Jun 1935, *Blake* 9573A; Townsville, on open exposed slopes of Castle Hill on sandy soil, Jun 1934, *Blake* 5937, and on exposed rocky slopes on Castle Hill, Mar 1935, *Blake* 8172A; S of Townsville between Stuart and Alligator Creek Meatworks, on barer areas on stony or gravelly ridges, May 1942, *L. S. Smith* T.4.

S. occultum is well distinguished by the narrow insignificant sessile spikelet tightly wedged in between the much more conspicuous joint and pedicel, the latter with its spikelet at first sight appearing to be the sessile spikelet because of its size and form and scarcely distinct spikelet; the very stout joints are much less oblique at the tip than usual. It approaches the extra-Australian *S. exile* (Hochst.) Pilger in the form of the sessile spikelet but this species has the leaves gradually narrowed to an acute tip, less stout joints and pedicels, more developed pedicelled spikelet articulate to the 2-lobed tip of the pedicel, and even narrower sessile spikelet more rounded on the back. The long fine hairs at the base of the leaf-blades produce a more conspicuously bearded effect than found in the other species. *Blake* 5937, 8172A, 9573A, 13388A, 13572B and 21844A are all of plants that were growing in association with other species, either *S. fragile* (5937, 8172A) or *S. pseudeulalia* (9573A, 13388A) or with both these and *S. pachyarthron* (21844A), or with *S. fragile, S. crinizonatum* and *S. dolosum* (13572B). *McKee* 9152 is mixed with *S. pseudeulalia.*

7. **Schizachyrium dolosum** S. T. Blake; species nova, facie *S. pseudeulaliae* (Hosokawa) S. T. Blake formas racemis pilosis simulans, sed foliis angustioribus spiculis sessilibus a latere compressis callo longiore minus obtuso ejus cicatrice angustiore praecipue differt; quoad spicula sessilis lateraliter compressa habitusque *S. occulto* S. T. Blake accedit sed spicula caryopsique latioribus pedicello pro ratione angustiore inter alia signa distinguenda. Typus: Queensland, Croydon versus, *Blake* 19617 (BRI. 061524, 061529); isotypi distribuendi.

Gramen annuum gracile ramosum. Culmi singuli vel fasciculati, usque 1 m longi, 7–11-nodes, simplices vel sursum parce ramosi ramis singulis vel 2–3-nis interdum ramulosis. Foliorum vaginae laeves, auriculis ± puberulis exceptis glabrae; ligulae 0·2–0·4 mm longae; laminae basin versus sensim angustatae sursum apicem obtusum versus paulo angustatae, conduplicatae, supra pubescentes cum marginibus ± scaberulae atque ligulam versus cum marginibus longe pilosae pilis circa 0·4–1 mm longis sine tuberculo basali plerisque conduplicatione laminae obtectis, ceterum glabrae laevesque, ± 2–6 cm longae, 0·8–1·5 mm latae (explanatae), vaginis multo angustiores et 1·5–3-ies longiores. Spatheolae primo ± convolutae tandem fere planae, 2·5–4·5 cm longae, 3–4 mm latae (explanatae), laeves vel ± asperulae. Pedunculi plerumque brevissimi 2–6 mm longi $\frac{1}{15}$ – $\frac{1}{7}$ spatheolae aequilongi, terminales interdum longe exserti usque ad 6 cm longi. Racemi (3–)4–7-articulati, 1·7–2·5 cm longi, ± 1–1·2 mm crassi. Articuli pedicellique approximati, ± tumidi inferne pilosi sursum glabri, spiculae sessili fere aequilongi vel vix breviores; articuli fere oblongi sursum 0·8–1 mm lati apicem versus paulo obliquum crenulatum ciliolatum paulo angustati, basi 0·6 mm lati in parte inferiore dorso marginibusque pilosi haud argute ciliati; pedicelli anguste obovati, basi 0·45–0·5 mm supra medium 0·75–1 mm lati, inferne a medio utrinque ciliati et basin versus dorso pilosi. Spicula sessilis a latere compressa cum gluma superiore inter articulum pedicellumque arcte inclusa, angustissime ovata apice bifido excepto acuta, 4·3–8 mm longa, 0·55–0·9 mm lata, 7–10-ies longiores quam latiores; callus rectus vel fere rectus, cuneatus, anguste obtusus fronte verticaliter sulcatus, 0·8–1·3 mm longus, pilis usque ad 1·5 mm longis barbatus; cicatrix suberecta, anguste ovata vel ovata vel elliptico-ovata, 0·3–0·65 mm longa, 0·15–0·2 mm lata. Gluma inferior tenuiter coriacea a medio vel prope medium sursum acute bicarinata inferne incurva carinis haud marginata flexuris ± 0·2 mm latis prope medium sese ± tangentibus, dorso sursum fere plana inferne valde convexa, subter medio laxe longeque pilosa vel glabra inter carinas nervis 2–3 tenuissimis percursa. Gluma superior illam fere adaequans, uninervis, supra vel etiam infra medium carinata carina scaberula in apicem triangularem percurrente. Lemma inferum circiter $\frac{4}{5}$ longitudinis glumarum aequans. Lemma superum profunde bifidum lobis ciliatis; arista 12–18 mm longa, ejus columna 6–8 mm longa. Antherae 0·3–0·5(–1·1) mm longae. Caryopsis linearis vel ovato-linearis supra embryonem compressa, 2·3–2·5 mm longa, 0·45–0·6 mm lata, 0·3–0·5 mm crassa; embryo dimidium caryopseos fere attingens, trigonus, endospermate multo crassior. Spicula pedicellata persistens continuationem pedicelli simulans ad gluman parvam aristatam reducta, 1–1·5 mm longa; arista 12–18 mm longa.

Culms up to 1 m long, about 0·35–0·8 mm thick, 7–11-noded, uppermost internodes with a few long hairs at the edge of the furrow in the upper part, simple or sparsely branched in the upper part, branches up to 3 together some of them sometimes up to 3-noded and again branched. Leaf-sheaths smooth and glabrous except for the ± puberulous auricles; ligules 0·2–0·4 mm long; blades gradually narrowed to base, slightly narrowed in the upper part, obtuse, folded-convolute, ± scaberulous on margins and upper surface, pubescent and also long pilose on upper surface towards the ligule the hairs 0·4–1 mm long or more without a tubercled base and mostly hidden by the folding of the blade, otherwise glabrous and smooth, about 2–6 cm long, 0·8–1·5 mm wide when flattened, much narrower than and 1·5–3 times as long as the sheath. Spatheoles at first ± convolute at length nearly flat, 2·5–4·5 cm long, 3–4 mm wide when flattened, smooth or ± asperulous. Peduncles mostly very short, 2–6 mm long, $\frac{1}{15}$ – $\frac{1}{7}$ as long as spatheole, terminal ones sometimes long exserted and up to 6 cm long. Racemes (3–)4–7-jointed, 1·7–2·5 cm long, about 1–1·2 mm thick. Joints and pedicels approximate, ± swollen, hairy below, glabrous upwards, almost as long to about

as long as the sessile spikelet; joints nearly oblong, 0·8–1·0 mm wide in the upper part, narrowed a little to the slightly oblique, crenulate ciliolate tip and to about 0·6 mm wide at base, pilose on back and margins in the lower part, not neatly ciliate; pedicels narrowly obovate, 0·45–0·5 mm wide at base, 0·75–1 mm wide above the middle, ciliate on both margins from about the middle downwards and pilose on back towards the base. Sessile spikelet laterally compressed, with the upper not lower glume wedged between joint and pedicel, very narrowly ovate, acute except for the bifid tip, 4·3–8 mm long, 0·55–0·9 mm wide, 7–10 times as long as wide; callus straight or nearly so, cuneate, narrowly obtuse, longitudinally furrowed in front, 0·8–1·3 mm long, bearded with hairs up to about 1·5 mm long; callus-scar suberect, somewhat narrowly ovate to ovate or eliptic-ovate, 0·3–0·65 mm long, 0·15–0·2 mm wide. Lower glume thinly coriaceous, sharply 2-keeled from about the middle incurved below, keels not marginate, flaps ± 0·2 mm wide about touching near the middle, back nearly flat upwards, much convex below, loosely long pilose below the middle or glabrous, with 2–3 very fine intracarinal nerves. Upper glume almost as long, 1-nerved, keeled from about the middle or more, keel scaberulous, percurrent in the triangular tip. Lower lemma about $\frac{4}{5}$ as long, nerveless. Upper lemma with ciliate lobes and an awn 12–18 mm long, with the column 6–8 mm long. Anthers 0·3–0·5(–1·1) mm long. Grain linear or narrowly linear-ovate, compressed above the embryo, 2·3–2·5 mm long, 0·45–0·6 m wide, 0·3–0·5 mm thick; embryo nearly half as long, trigonous, much thicker than the endosperm. Pediceled spikelet 1–1·5 mm long; awn 12–18 mm long. Figs. 1G, 5.

QUEENSLAND.—Cook District: about 40 miles NW. of Mungana, in *Melaleuca* forest on fine whitish sand, Apr 1938, *Blake* 13735; near Chillagoe, in damper places in open forest on grey sandy soil, Apr 1938, *Blake* 13572A; Cairns, on steep grassy hillsides, chiefly in the damper places, Mar 1938, *Blake* 13357. Burke District: towards Croydon from "Esmeralda" (13 miles), sandy seepage slope dominated by *Melaleuca viridiflora*, Jul 1954, *Blake* 19617, *Lazarides* 4734.

S. dolosum has considerable resemblance to some states of *S. pseudeulalia*, especially those with conspicuously hairy racemes, but besides the narrower leaves and laterally compressed not acuminate mostly narrower sessile spikelets with longer less obtuse callus longitudinally furrowed in front, the callus-scar is narrower, the lower glume is keeled only in the upper part with less sharply inflexed flaps nearly touching, and the narrower grain has a trigonous embryo much thicker than the endosperm. In habit and the narrow laterally compressed sessile spikelet there is a strong resemblance to *S. occultum*, but the sessile spikelet is broader and more conspicuous with the flaps of the lower glume about touching, the pedicel scarcely resembles a sessile spikelet, and the broader grain has the relatively larger embryo thicker than the endosperm.

There is a wide range of material in *Blake* 19617 from solitary culms only 5 cm high with a single immature raceme and sheathed all along to tufted plants with branched culms up to 1 m long. Some of the culms have the terminal racemes long exserted from tightly convolute spatheoles with chasmogamous spikelets with anthers 1·1 mm long; the majority of spikelets are cleistogamous with smaller anthers. *Lazarides* 4734 was collected simultaneously. *Blake* 13357 is very young with the marginal hairs of the base of the leaf-blade up to 2 or even 3 mm long, some from a tubercle at base. All my collections are of plants that were growing with or close by *S. fragile;* 19617 and 13572A were also associated with *S. crinizonatum* and 13572A with *S. occultum* as well.

CYMBOPOGON

Cymbopogon Spreng. Plant. Pugill. 2:14 (1815); Stapf, Kew Bull. 1906:297 (1906), Fl. Trop. Afr. 9:265 (1918); Domin, Biblioth. Bot. 85:273 (1915); A. Camus, Rev. Bot. Appliq. 1:270 (1921) and in Lecomte, Fl. Indo-Chine 7:336 (1922); Pilger, Naturl. Pfl.-fam. ed. 2, 14e:162 (1940); S. T. Blake, Univ. Qd Pap. Dept. Biol. 2(3):55 (1944), Proc. Roy. Soc. Qd 80:69 (1969); C. A. Gardner, Fl. W. Aust. 1:337 (1952); Bor, J. Bombay Nat. Hist. Soc. 51:890 (1953); Roberty, Boissiera 9:172 (1960); W. D. Clayton, Kew Bull. 19:454 (1965), Kew Bull. Addit. Ser. 2:6, 7, 35 (1969). Type (lectotype): *C. schoenanthus* (L.) Spreng. (*Andropogon schoenanthus* L.).

Andropogon L. subgen. *Cymbopogon* (Spreng.) Nees, Fl. Afr. Austr. 109 (1841). Based on *Cymbopogon* Spreng.

Andropogon L. sect. *Cymbopogon* (Spreng.) Benth. Fl. Aust. 7:528, 532 (1878) and in Benth. & Hook. Gen. Pl. 3:1134 (1883). Based on *Cymbopogon* Spreng.

Gymnanthelia Anderss. in Schweinf. Beitr. Fl. Aethiop. 299 (1867), *nomen.*

Andropogon L. subgen. *Cymbopogon* (Spreng.) Nees sect. *Gymnanthelia* Hack. in DC. Monogr. 6:594 (1889). Based on *Gymnanthelia* Anderss.; several syntypes including the type of *Cymbopogon; nomen illegit.*

Andropogon spp.: R. Br. Prodr. 202 (1810); Steud. Syn. Pl. Glum. 1:385, 390 (1854).

Sorgum spp.: O. Kuntze, Rev. Gen. Pl. 2:791 (1891).

Spikelets 2-nate, those of each pair differing in sex and more or less in shape—except those of the lower pair of the lower or of both racemes which are homogamous (♂ or neuter) one sessile ⚥ , the other pedicelled, on the articulate fragile rhachis of several jointed paired racemes with subequal flattened raceme-bases, terminating the culms and their branches; raceme-pairs supported by a spatheole, collected into often decompound or supra-decompound spatheate panicles, the ⚥ fertile spikelets falling with the contiguous joint and the accompanying pedicel; joints and pedicels filiform or linear with frequently more or less cupular or auricled tips, those of the lowest pair (raceme-base) often conspicuously swollen, oblong or barrel-shaped and hard. Florets 2, lower reduced to an empty lemma, upper ⚥ in the sessile spikelets of the heterogamous pairs, ♂, rarely neuter, in those of the homogamous pairs and in the pedicelled spikelets. Fertile spikelets dorsally, rarely laterally, compressed, awned in most species; callus very short, obtuse, usually bearded, inserted in the excavated tip of the joint. Glumes equal or subequal, more or less chartaceous, the lower almost flat or slightly depressed or narrowly grooved on the back with at least from the middle upwards sharply inflexed margins, 2-keeled, the upper more or less boat-shaped, keeled upwards, usually 1-nerved. Lemmas ciliate or ciliolate (sometimes obscurely), of the lower floret entire, hyaline, 2-nerved, of the upper 2-fid or 2-lobed, hyaline, rarely firmer and almost stipe-like below the insertion of the awn; column of awn, if any, smooth or minutely scabrid on the edges, glabrous. Palea O. Lodicules 2, minute, subcuneate, faintly nerved, glabrous. Stamens 3. Stigmas laterally exserted; styles terminal. Grain narrow, oblong to elliptic or obovate in outline, subterete to plano-convex in cross-section; embryo about half the length of the grain. Pedicelled spikelets usually ± different in shape and size from the sessile, but never depressed or grooved on the back. Glumes muticous, the lower chartaceous to subchartaceous, the upper thinner. Of the lemmas only that of the lower floret present, hyaline, 2-nerved; upper floret usually represented by a naked ♂ flower, rarely suppressed. Perennial (rarely annual?), tufted, aromatic, often tall grasses; leaves often very coarse, usually reddish or withering, their sheaths auricled at the top, the auricles adnate to the membranous, scarious, or at length chartaceous sometimes short ligules; blades commonly with a ± triangular ± thickened (glandular?) dark-coloured area on each side of the midrib at the back of the base of the blade sometimes extending round the margins to the upper surface; spathes and spatheoles at length reddish; racemes often reflexed at maturity frequently conspicuously even densely white-hairy with joints and pedicels (except often in *C. refractus*) hairy on the margins and sometimes also on the back or all over; glumes sometimes with conspicuous oil-streaks. Type (lectotype): *Cymbopogon schoenanthus* (L.) Spreng. (*Andropogon schoenanthus* L.).

Cymbopogon is a well marked genus of about 60 species in Africa, Asia, Malesia, Australia and some Pacific islands. It is allied to *Hyparrhenia* on the one hand and *Andropogon* sect. *Andropogon* on the other, agreeing with the former in having spatheate panicles of paired few-jointed racemes the lower of each pair having a homogamous basal pair of spikelets, and with the latter in having spikelets with an obtuse callus sitting in the expanded concave tip of the joint and a prominently 2-keeled lower glume of the sessile spikelet ± concave between the keels and a glabrous awn; it differs from both in that the plants are aromatic.

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When Sprengel described *Cymbopogon* he included four species, one of which (*C. glandulosus* Spreng.) is now treated as a species of *Iseilema* (*I. prostratum* (Willd.) Anderss.) and two other (*C. elegans* Spreng. and *C. humboldtii* Spreng.) are now referred to *Hyparrhenia* as *H. cymbaria* (L.) Stapf and *H. bracteata* (Humb. & Bonpl. ex Willd.) Stapf. The typification of *Cymbopogon* and the history of the application of the name *Hyparrhenia* were discussed by Clayton (1969).

Cymbopogon was usually treated as a section or subgenus of *Andropogon* until Stapf (1906) dealt with a number of economically important oil-producing species and later (1918) gave a more detailed description of the genus and at the same time distinguished *Hyparrhenia* as a distinct genus. Hackel treated it as *Andropogon* subg. *Cymbopogon* with two sections, sect. *Hyparrhenia* (now generally treated as a distinct genus and recently monographed by Clayton (1969) and sect. *Gymnanthelia* which included the lectotype of *Cymbopogon* and should have been called sect. *Cymbopogon*. Domin (1915) transferred to *Cymbopogon* some Australian species described by R. Brown under *Andropogon* but not *A. refractus*. A. Camus (1921) gave a review of the genus based chiefly on Hackel's treatment, treating as species those taxa treated as subspecies by Hackel. She presented a key and made many new combinations, but it is doubtful if she studied many specimens. Roberty (1960) accepted the genus as circumscribed by Stapf but treated all the taxa he recognized as subvarieties of a single species *C. schoenanthus*, all names of which are invalid (Clayton, 1969 and Blake, 1969).

The Australian species are decidedly variable in appearance. The plants are densely leafy at the base with intravaginal or also some extravaginal innovations, emitting a strong (usually weak in *C. refractus*) citrine scent when bruised, with 1–6-noded simple ± striate culms below the inflorescences, the internode immediately beneath the inflorescence channelled along one side, the others terete; the leaves have membranous ligules, persistent striate sheaths rounded on the back, and relatively long and narrow or very narrow blades attenuate to a filiform tip, attenuate or narrowly rounded at the base, scabrous on the margins and usually also on the lower surface (sometimes smooth in *C. ambiguus*), often with long fine hairs close to the ligule but otherwise glabrous or nearly so; the panicles are contracted, often long and narrow, erect or more or less nodding, occupying $\frac{1}{10}$–$\frac{2}{3}$ the length of the culm, 3–11-noded, branched up to but not beyond the third degree with the primary branches (partial panicles or rays) usually 2–4 nate at the middle nodes, densely woolly or silky to about glabrous, with spatheoles acute at each end closely nerved on the back with narrower hyaline margins 1·5–3·5 cm long and their peduncles $\frac{1}{7}$ – $\frac{3}{5}$ as long; the racemes are 2–7-jointed, nearly erect to reflexed, with the lowermost pair of spikelets of the subsessile raceme almost always homogamous, its pedicel not adnate and not more swollen than the others, if at all, the sessile spikelet sometimes shrinks unevenly in drying so that its shape in the dry state may change on wetting;

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the lower glume may be flat or concave or grooved between the keels in the lower part, but the narrow deep slit developed in some Asiatic species does not occur in the Australian species nor is there any conspicuous wrinkling.

C. refractus differs from other species of the genus in having unusually broad and thick joints and pedicels which, like the callus are usually glabrous and also in the persistent ± squarrose or uncinate pedicelled spikelets which form an effective dispersal mechanism. The variation in appearance between plants of any species may depend on variation in density and to some extent the length of the hairs on the joints and pedicels or to variations in the width of the leaves or both. Other variations are in the size and to a less extent the shape of the sessile spikelet, the degree of development of a membranous margin or wing to each of the keels of its lower glume, the number and extent of development of the veins between the keels, the depth of the concavity on the back and, in some species, the degree of development of the awn. Especially in *C. bombycinus* the shape of the spikelet alters during drying and on subsequent wetting.

KEY TO AUSTRALIAN SPECIES OF CYMBOPOGON

- Inflorescence short and dense usually occupying $\frac{1}{10}$–$\frac{1}{5}$ the length of the culm with all internodes of the axis short or 1–2 lowermost ± elongated; hairs of racemes not hiding the spikelets; each spikelet of the homogamous pairs reduced to one small often ± inrolled glume often caducous; culms 1–1·5 m high with 4–6 nodes below the inflorescence, the racemes usually reflexed at maturity *C. globosus*
- Inflorescence occupying $\frac{1}{5}$–$\frac{2}{3}$ the length of the culm usually not dense with well distributed racemes which are very densely hairy to glabrous; homogamous pairs of spikelets not very different in size and shape from the upper ones, very occasionally absent; culms 3–5-noded below the inflorescence and up to 2·5 m high in *C. procerus* (with erect to spreading racemes), 1–3-noded and rarely exceeding 1 m in the others:
  - Joints and pedicels densely hairy over all or most of the back as well as the margins, the hairs 4–7 mm long often hiding the sessile or all spikelets; racemes usually not exceeding the spatheoles before exsertion:
    - Longer callus hairs up to 1·3 mm long, much less than half the length of the sessile spikelets; sessile spikelets narrowly or very narrowly oblong to elliptic, not or only very narrowly marginate; racemes ± erect; awn perfect, column 4·5–7 mm long:
      - Plant tall, commonly 1·5–2·5 m high with 7–11 noded panicles: sessile spikelets 0·6–0·7 mm wide, neatly narrowed to both ends from or from near the middle, the lower glume with 0–4 intracarinal nerves usually short, 2 sometimes extending nearly throughout 2. *C. procerus*
      - Plant rarely as tall as 1·5 m, with 4–8-noded panicles; sessile spikelets 0·7–1 mm wide, sometimes very narrowly marginate upwards, narrowly oblong to narrowly elliptic-oblong, nearly parallel-sided from about the middle downwards; lower glume with 2–5 intracarinal nerves of which 2 are usually prominent nearly throughout 3. *C. ambiguus*

Longer callus hairs about 3·5–5 mm long from more than half to nearly as long as the sessile spikelets; sessile spikelets from very narrowly ovate to obovate to somewhat oblong, winged or not; racemes erect or reflexed; awn often imperfect, column if present up to 5 mm long; joints and pedicels hairy also in front:

Old leaf-sheaths becoming flat and recurved or rolled back, up to 6 mm wide; spatheoles ± pubescent towards base and on hyaline margins; racemes mostly erect; lower glume of sessile spikelets with keels converging below middle and then diverging to the base, scarcely marginate upwards, and with 0–2 short intracarinal nerves in the upper part; awn 1–21 mm long 4. *C. bombycinus*

Old leaf-sheaths straight and inrolled or if flexuous and ± flat then only 2–3 mm wide; spatheoles glabrous; racemes early reflexed; lower glume of sessile spikelets ± marginate upwards, the keels straight or nearly so below the middle almost or quite to the base, and with 2–5 intracarinal nerves of which 2 are prominent throughout; awn 6–8 mm long, column 0–2 mm long 5. *C. obtectus*

Joints and pedicels glabrous or ciliate on the margins only, rarely with additional hairs on the back of the joint, the hairs not more than 3 mm long and never concealing the spikelets; racemes soon spreading and then becoming reflexed, exceeding the spatheoles before exsertion:

Joints and pedicels ciliate, slender: sessile spikelet ± winged upwards with bearded callus and well developed awn; pedicelled spikelets very narrowly ovate with straight tip, at length disarticulating 6. *C. queenslandicus*

Joints and pedicels commonly glabrous: sessile spikelet not at all winged with glabrous or nearly glabrous callus nearly always awnless or with a smaller imperfect awn; pedicelled spikelets subulate with a rigid hooked tip, usually persistent 7. *C. refractus*

1. Cymbopogon globosus Henr. Repert. Sp. Nov. 22:106 (1925); S. T. Blake, Proc. Roy. Soc. Qd 80:71 (1969). Type: Moluccas, Taliabu (Soela), *Atjeh* 61 (L).

Andropogon moluccanus Backer ex Henr. loc. cit. pro syn.

Culms erect, 1–1·6 m high (up to 2·7 m fide Darbyshire), mostly 4–6 noded below the inflorescence, topmost internode ± scabrous ciliolate on the edges towards the top, the others smooth and glabrous. Leaf-sheaths, the upper shorter the lower longer than the internodes, smooth, glabrous or (chiefly the lower ones) slightly pubescent close to and at the nodes, those of the basal leaves pubescent below, at length spreading and flattening but apparently not as persistent as in the other Australian species; ligule 2·5–5·5 mm long, apex ciliolate; collar glabrous or puberulous; blades narrowed to base, soon flat, glabrous or puberulous beneath at the base, smooth above densely scaberulous beneath, scabrous towards the tip, with 3–5 pairs of lateral nerves up to 60 cm or more long, mostly 3–8 mm wide. Panicle usually short, commonly occupying $\frac{1}{10}$–$\frac{1}{5}$ the length of the culm, often with the racemes densely aggregated into a single broadly or very broadly ovoid to oblong mass 6–13 cm long about 5–9 cm wide, sometimes more elongated and sometimes interrupted below with the lower internodes much elongated but in any case the racemes densely aggregated towards the ends of the branches, about 7–9-noded, branched to the 2nd or 3rd degree; axis obliquely bearded at or below the nodes; branches at least in the upper part of the panicle very much longer than the internodes. Spatheoles very narrowly elliptic, scaberulous on the midvein in the upper part otherwise smooth, glabrous, 14–22 mm long. Peduncles filiform, hairy towards top, 3–11 mm long, $\frac{1}{7}$ – $\frac{1}{2}$ as long as the spatheole. Racemes at first ± overtopped by the spatheole, soon diverging and at length commonly epinastically reflexed, 10–15 mm long with 3–5 awned spikelets; subsessile raceme with the lowest pair of spikelets homogamous, much reduced like the pedicel, commonly to one small glume, both readily falling away and perhaps sometimes absent from the first. Joints and pedicels linear, flattened to ± concave ventrally, flattened to ± convex on the back chiefly along the middle line, slightly dilated below the ± obliquely cup-shaped irregularly lobed or denticulate tip, ciliate on the margins with hairs increasing upwards to 3·5 mm long and also villous on the back in the upper part, 2·3–3·2 mm long, 0·15–0·2 mm wide, about $\frac{2}{3}$ as long as the sessile spikelets, equal or the pedicel shorter joint longer by up to 0·5 mm. Sessile spikelets narrowly ovate, acutate to a subtruncate or irregularly obtuse narrow tip, (3·8–) 4–5 mm long, 0·8–1 mm wide, 5–6 times as long as wide; callus hairs up to 1·2 mm long. Lower glume relatively thin, 2-keeled throughout, the margins inflexed from about the middle and the keels marginate from there up to a width of less than 0·1 mm and scaberulous on the edges, with 3 or 4 fine intracarinal nerves, flat on the back in the upper or greater part, depressed along the middle or concave towards or sometimes only very close to the base. Upper glume 3-nerved with a marginate keel above the middle. Lower lemma about oblong a little shorter than the glumes. Upper lemma about as long as the lower, lobed to about $\frac{1}{3}$–$\frac{1}{2}$ the length; awn perfect, 11–13 mm long. Pedicelled spikelets usually neuter, narrow linear to very narrowly somewhat ovate, acute 2·5–4·3 mm long. Lower glume with 5–7 intracarinal nerves 3 nearly percurrent, the others shorter; upper glume rudimentary or absent, rarely well developed. Fig. 6.

QUEENSLAND.—Cook District: Lockerbie Stn., 10 miles SW of Somerset, occasional in moist watercourse in savannah forest, 50 m, May 1948, *Brass* 18590; 1 mile SW of Red Island Point, common in savannah forest on red lateritic soil, ± 10 m, May 1948, *Brass* 18819.

Also in New Guinea and the Molluccas (Fig. 6 and Blake, loc. cit.) In the type and a few other specimens the inflorescence is a dense globose mass with all the internodes of the axis much shorter than the branches, giving a very distinctive appearance to the specimens, but in others one or more of the lower internodes is much elongated so that the inflorescence becomes interrupted and somewhat resembles that of *C. ambiguus* or *C. queenslandicus;* Merrill, Interpt. Rumph. Herb. Amboin. 89 (1917), referred *Robinson Pl. Rumph. Amboin.* 46 from Amboina to the former (as *Andropogon exaltatus*), C. T. White referred

White 3 from Port Moresby (Papua), to the latter in Proc. Roy. Soc. Qd 34:15 (1922) as *Andropogon nardus* L. var. *grandis* Hack., and J. R. Reeder, J. Arnold Arb. 29:369 (1948), referred specimens from New Guinea seen by him to *C. procerus*. It differs from all of these in the short inflorescence with densely aggregated raceme-pairs and the much reduced ± caducous homogamous pair of spikelets of the subsessile raceme; from *C. ambiguus* and *C. queenslandicus* in the several-noded culm; from *C. ambiguus* and *C. procerus* in the ± reflexed racemes, much shorter hairs on the joints and pedicels, and frequently shorter awns; from *C. ambiguus* also in the more broadly marginate sessile spikelet less furrowed on the back with its lower glume thinner in texture like that of *C. procerus* from which it also differs in the stouter joints and pedicels, broader distinctly marginate sessile spikelets with distinct well developed intracarinal nerves in the lower glume; and from *C. queenslandicus* it further differs in the smooth upper surface of the leaves, the racemes shorter than the spatheole before expansion, joints and pedicels both hairy on the back, much less broadly obtuse scarcely winged (though marginate) sessile spikelet less prominently furrowed along the back and relatively smaller pedicelled spikelets.

2. Cymbopogon procerus (R. Br.) Domin, Biblioth. Bot. 85:273 (1915); S. T. Blake, Proc. Roy. Soc. Qd 80:70 (1969). Combination made independently by A. Camus, Rev. Bot. Appliq. 1:289 (1921). Based on *Andropogon procerus* R. Br.

Cymbopogon exaltatus (R. Br.) Domin, Biblioth. Bot. 85:273 (1915). Combination made independently by A. Camus, Rev. Bot. Appliq. 1:289 (1921). Based on *Andropogon exaltatus* R. Br. but applied to *C. ambiguus*.

Andropogon procerus R. Br. Prodr. 202 (1810). Type: Northern Territory, Groote Eylant, *R. Brown* [6172] (BM, holo; E, K)

Andropogon exaltatus R. Br. Prodr. 202 (1810); S. T. Blake, Proc. Roy. Soc. Qd 80:70 (1969). Type: Northern Territory, Mallinson's I., *R. Brown* [6173] (BM, holo, photo BRI; E, K, W).

Sorgum procerum (R. Br.) O. Kuntze, Rev. Gen. Pl. 2:791 (1891). Based on *Andropogon procerus*.

Sorgum exaltatum (R. Br.) O. Kuntze, Rev. Gen. Pl. 2:791 (1891). Based on *Andropogon exaltatus*.

Cymbopogon nardus (L.) Stapf subvar. *exaltatus* (R. Br.) Roberty, Boissiera 9:176 (1962).

Cymbopogon nardus (L.) Stapf subvar. *exaltatus* (R. Br.) Roberty, Boissiera 9:174 (1962).

Culms erect, 1–2·2 m high up to 9 mm wide, 3–5-noded beneath inflorescence, the internodes smooth, or somewhat scaberulous near the next node, ± pubescent and also ± pruinose at and just below nodes. Leaf-sheaths smooth, somewhat bearded at the mouth or glabrous, the lowermost ones ± pubescent towards the base, those of the culm leaves puberulous at the nodes and sometimes pubescent near the collar otherwise glabrous, usually shorter or much shorter than the internodes, the basal ones persistent spreading straight inrolled; collar pubescent to bearded; ligules about 2·7–7 mm long: blades flat, gradually narrowed to base, glabrous except sometimes the auricles of the sheath and a row of long hairs behind the ligule, upper surface smooth, lower densely scaberulous less so in the middle part, more coarsely scabrous on the margins with 5–8 pairs of secondary nerves, 5–15 mm wide, up to 50 cm long. Panicle occupying about ⅓–½ the culm, about 40–90 cm long, about 5–8 cm wide, 7–11-noded, branched to the third degree, contracted, narrow and dense; main axis ciliate on the angles just below the nodes rarely also densely long pubescent, the nodes themselves glabrous; branches up to 4 together in the middle part of the panicle, the longer ones commonly as long as two internodes of the axis (rarely the lower ones only reaching to the next node — *Lazarides* 5078); ultimate branches 9–12 mm long. Spatheoles very narrowly elliptic ovate, at length ± inrolled, scaberulous on the midnerve elsewhere smooth, glabrous, 17–20 mm long, 2–3·2 mm wide when flattened. Peduncles filiform, ciliolate upwards and ± scabrous, (3–)7–10 mm long, ⅛–⅓ as long as the spatheole. Racemes much overtopped by the spatheole before exsertion, at length exserted well below the middle (from the bottom third), very little divergent, finely long hairy but the hairs not concealing the spikelets, 6·5–19 mm long with 2–5 awned spikelets each; joints and pedicels nearly equal, flattened-filiform, ± concave on the ventral surface and there glabrous, ± convex on the back, slightly dilated beneath the lobed and toothed cup-shaped tip, 2·3–3·5 mm long, densely hairy with long fine hairs along the margins and over all or all but the lower part of the back, the hairs increasing in length upwards up to 5–6 mm long, but not concealing the spikelets, ½–⅔ as long as the sessile spikelet. Sessile spikelets very narrowly elliptic or somewhat ovate or obovate when dry (widest just below to just above the middle), gradually acute or somewhat acuminate, pallid, 4–5 mm long, 0·6–0·7 mm wide (6–8 times as long as wide); callus hairs up to 0·7–1·1 mm. Lower glume 2-keeled from the base, the margins inflexed in the upper half, the keels there scarcely marginate, scaberulous, with 0–4 slender intracarinal nerves, 2 sometimes extending nearly throughout the others shorter to very short, back flat in the upper part, concave between the keel-nerves in the lower half or more, glabrous. Upper glume 3-nerved, narrowly marginate on the keel. Lower lemma narrowly oblong, about ⅔ as long as the lower glume. Upper lemma bilobed for about ⅓ of its length, about half as long as the lower glume; awn perfect, 10·5–19 mm long, column about ⅓–½ as long. Grain compressed, narrowly ellipsoid, 2·1–2·3 mm long, 0·6–0·9 mm wide; embryo half as long. Pedicelled spikelets neuter, sometimes male, very narrowly ovate or ovate-linear, acute 3·2–4·2 mm long. Lower glume with 3 or 5 intracarinal nerves. Upper glume shorter or 0. Fig. 7.

WESTERN AUSTRALIA.—Northern Province: Carson R., in 1891, *Bradshaw & Allen;* Champagny I., Bonaparte Archipelago, on coastal sandstone, May 1972, *Wilson* 10950; Augustus I., Bonaparte Archipelago, top of sandstone cliff, May 1972, *Wilson* 10686; Prince Regent R., Jul 1921, *Gardner;* Glenelg R., *Martin;* Balmaningarra, Apr 1916, *Basedow* 12 N.W.; Lennard R., May 1905, *Fitzgerald* 669, 857; base of Mt Broome, May 1905, *Fitzgerald* 837; Mt Anderson, Aug 1905, *Fitzgerald;* 10 miles NW of Elgee Cliffs Stn., common in sandstone gorge amongst boulders with *Pandanus* sp., Apr 1955, *Lazarides* 5093; half-mile SW of Bedford Downs Stn., occasional on skeletal soil with *Eucalyptus brevifolia* and *Aristida* sp., Apr 1955, *Lazarides* 5078; Ord R. gorge, quartzitic rocks in declivites, Jun 1944, *Gardner* 7353; West Bastion Range, Cambridge Gulf, in 1886, *Ranford & Nynlasy* 8; Deception Range, rocky ground, Jun 1952, *Langfield* 306; Argyle Downs Stn., Sep 1916, *M.P. Durack;* Ord River, Apr-May 1945, *K.M. Durack.*

NORTHERN TERRITORY.—Darwin and Gulf District: Melville I., hill above Snake Bay Settlement, open forest, skeletal soil, Apr 1966, *Stocker & Fox* 490; Point Stephens, Adam Bay, near beach in mixed open forest, Sep 1946, *Blake* 16957; Port Darwin, *Schultz* 147, 189, 241, 262; Shoal Bay, Darwin, in scrubs, Jun 1967, *Symon* 5170; Nightcliff, Darwin, frequent in *Eucalyptus tetrodonta* open forest on truncated lateritic podzol, Mar 1948, *Specht* 39; Darwin, stony low slope in *Eucalyptus* forest, ± 15 m, Sep 1946, *Blake* 17066; 6 miles E of Darwin, McMillan's Road, sandy ironstone soil, low lying, locally abundant, Mar 1946, *Hartley* hb. no. 11772; near Darwin, Jun-Jul 1911, *Gilruth & Spencer;* Fog Bay, 12° 48′ S, 130° 21′ E, seaward edge of low headland, 5 m, also further inland in depression, Aug 1946, *Blake* 16776; 36 miles SW of Dorisvale Stn., crevices in rocky sandstone hill, May 1952, *Lazarides* 2795; base of Edith Falls, about the lake edges, Jun 1967, *Symon* 5130; Katherine Gorge, 15 miles E of Katherine, common on sandstone walls in cracks and crevices, Mar 1964, *Lazarides* 7036; 19 miles NE of Katherine, occasional on stony slopes of gorge with *Plectrachne* sp., Feb 1965, *Wilson* 333; Katherine Gorge, on rock faces, Jun 1967, *Symon* 5112; 44 miles SW of Katherine on top of steep hill, Jun 1949, *Perry* 2001; Hodgson Downs Stn., ± 15° 30′ S, 134° 05′ E, on rugged sandstone hills with *Eucalyptus pallidifolia* [= *E. brevifolia*] and *Plectrachne* sp., 107 m, Apr 1947, *Blake* 17561, 17562; Mallinson I., on damp rocks, Mar 1803, *R. Brown* [6173]; Yirrkala (12° 12′ S, 136° 47′ E) in *Eucalyptus* forest on truncated lateritic podsol, Aug 1948, *Specht* 1000; South Bay, Bickerton I., at base of sandstone hills, Jun 1948, *Specht* 621; Hemple Bay, Groote Eylandt, between quartzite boulders, May 1948, *Specht* 369; [North West Bay], Groote Eylandt, Jan 1803, *R. Brown* [6172]; near "Tanumbirini", amongst rocks, sandstone ranges, Mar 1912, *Hill* 812; Tanumbirini Stn., 16° 18′ S, 134° 52′ E, rare in skeletal soil on rocky quartzite-conglomerate hill with *Plectrachne pungens* and *Eucalyptus* spp., Jun 1971, *Latz* 1401; 9 miles NW of Calvert Hills aerodrome on rocky hills, Jun 1967, *Symon* 5060; Settlement Creek, Jun 1922, *Brass* 160. Victoria River District: near Alligator Spring, 70 miles E of Carlton Stn. (W.A.), on steep rocky quartzite hill, Jul 1949, *Perry* 2618; 14 miles W of Victoria River Downs Stn., Jun 1949, on steep slopes of flat-topped hill, *Perry* 2107; Victoria River, 200 miles up the river, top of rocky hills, Dec 1855, *F. Mueller*; Tanami, Aug-Sep 1910, *Warden of Tanami.*

The larger specimens with stout culms, broad leaves, large panicles and small spikelets are unlike those of other Australian species, but smaller specimens about 1 m high such as *Specht* 369 and *Lazarides* 5078 are very like robust states of *C. ambiguus. C. procerus* has more nodes beneath the panicle, the internodes shorter with relatively short leaf-sheaths, panicles occupying a greater proportion of the culm with the longest branch from each node commonly as long as the next two internodes of the main axis, narrower spatheoles broadest a little below instead of about the middle, narrower joints and pedicels only about half as wide but relatively rather longer with few and somewhat longer hairs, sessile spikelets widest at or near the middle and gently narrowed above and below not nearly parallel-sided as in *C. ambiguus,* decidedly narrower with more slender veins and rather evenly sometimes deeply concave between the keel-nerves instead of having the narrower if deeper furrow of *A. ambiguus* the sides of which are convex; the lower glume of the pedicelled spikelet has fewer nerves.

When he described *Andropogon procerus* and *A. exaltatus* Brown laid stress on the absence of intracarinal nerves in the sessile spikelet of the former and the presence of two such nerves in the latter. The type collection of the former has nearly consistently no intracarinal nerves but spikelets with 1 or 2 rudimentary ones were found, but that of the latter shows more variation, because although 2 intracarinal nerves are usually present they are sometimes short or faint and at times disappear altogether. The culm of the former was described as scaberulous and the latter as smooth but on the material seen of Brown's collection the culms seem indistinguishable; the relative length of the awns is certainly variable. *Lazarides* 7036 and *Wilson* 333 are small extremely slender plants with culms only 2 noded beneath the 6–7 noded inflorescences and very narrow leaves, with culm about 80 cm high on Wilson's specimen, and quite setaceous on *Lazarides* 7036 the culms of which are about 30 cm high. *Symon* 5112 is like *Wilson* 333.

Other collections show other combinations in the variation but the shape and size of the spikelet is fairly constant throughout.

Bentham and Hackel unfortunately identified *A. exaltatus* with the species here called *C. ambiguus* although both cited a Brown specimen. Characteristically the specimens look unlike though as mentioned above some specimens do look alike at first sight. Hackel was followed by Domin, A. Camus and by myself. Hackel restricted his concept of *C. procerus* to plants with no intracarinal nerves and described *A. procerus* var. *schultizii* based on *Schultz* 60, referring it to this species because of the absence of intracarinal nerves but distinguishable by the larger size of the spikelets. The type is a specimen of *C. bombycinus*, a species differing from *C. procerus* in its smaller size with broad flat recurving much more pubescent basal leaf-sheaths, fewer noded culms, partly pubescent broader elliptic spatheoles, more deeply and narrowly furrowed sessile spikelets the keels of which tend to inarch below in the dry state, and the stouter joints and pedicels villous on the inner side as well as on the back at least in the upper part, and also better developed pedicelled spikelets. Giles's specimen from Macdonnell Ranges referred to by Domin, Biblioth Bot. 20, heft 85:273 (1915) with a remark on the unusually broad leaves 2·5 cm wide and stout stems 7 mm wide was based on a sheet with inflorescences of *C. ambiguus* mixed with a leafy piece of *Phragmites australis.* The specimen of Clements also referred to with hermaphrodite spikelets of 6 mm or more belongs to *C. ambiguus. Andropogon procerus* and *A. exaltatus* were published simultaneously and so were *Cymbopogon procerus* and *C. exaltatus.* In adopting *C. procerus* for the species

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circumscribed here I have been influenced by the fact that the names *A. exaltatus* and *C. exaltatus* have been so widely used for the species here recognized as *C. ambiguus.*

C. procerus has been reported from Amboina and New Guinea but the specimens cited belong to *C. globosus* Henr. (S. T. Blake, Proc. Roy. Soc. Qd 80:71 (1969)).

3. **Cymbopogon ambiguus** A. Camus, Rev. Bot. Appl. 1:290 (1921); S. T. Blake, Proc. Roy. Soc. Qd 80:70 (1969). *Andropogon ambiguus* Steud. non Michx.

Andropogon ambiguus Steud. Syn. Pl. Glum. 1:385 (1854), non Michx. (1803). Type: "Ex Hrbo. Mus. Paris. N. Holl." "Iles steriles": Western Australia, Islands in Sharks Bay, *Baudin's Exped.* (P holo, photo BRI; BM, S).

Andropogon exaltatus R. Br. var. *ambiguus* (Steud.) Hack. in DC. Monograph. 6:596 (1889); Ic. Pl. 29:t.1689 (1889). Based on *Andropogon ambiguus* Steud.

Andropogon spectabilis F. Muell. ex Hack. op. cit. 594 in syn.; non K. Schum. (1897).

Cymbopogon exaltatus (R. Br.) Domin var. *ambiguus* (Steud.) Domin, Biblioth. Bot. 85:273 (1915). Based on *Andropogon ambiguus.*

Cymbopogon exaltatus (R. Br.) Domin var. *gracilior* Domin, Biblioth. Bot. 85:273 (1915). Type: Castle Hill near Townsville, Feb 1910, *Domin* (PR holo; K).

Culms erect, about 30–100 cm long, 1–3-noded below the inflorescence, the internodes smooth, glabrous or ± pubescent especially towards or at the nodes and there ± pruinose; nodes ± pruinose, pubescent or glabrous. Leaf-sheaths closely scaberulous on the nerves, the lower ones at first ± pilose-pubescent at length ± glabrous, those on the culm usually shorter than the internodes, usually the basal ones at length spreading, straight, ± inrolled rarely ± flat; orifice glabrous; collar glabrous; ligules about 2–4·5 mm long; blades flat, narrowed below or convolute and filiform throughout, abruptly widened to the sheath, commonly flexuose in the dry state, shortly and finely scabrous beneath becoming nearly smooth towards the base or smooth throughout, smooth or nearly so on upper surface, with 1–5 pairs of lateral nerves, mostly 15–50 cm long and 0·5–5 mm wide. Panicle occupying about $\frac{1}{5}$–$\frac{1}{3}$ the length of the culm, mostly 15–40 cm long, about 2·5–5 cm wide, 4–8-noded, narrow, dense or ± interrupted especially below, branched to the first or second degree; internodes of axis with 2–3 short lines of fine hairs below the nodes also pubescent or entirely

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glabrous, smooth to scaberulous on the edges; nodes glabrous or variously hairy, branches mostly exceeding the internodes, 2–4 together in the middle part, solitary or 2 together in the lower part. Spatheoles very narrowly elliptic, somewhat scaberulous on the midnerve in the upper part, sometimes also on other nerves towards the tip, elsewhere smooth, glabrous, 15–30 rarely 35 mm long. Peduncles 3–7·5 mm long, $\frac{1}{7}$ - $\frac{2}{5}$ as long as the spatheole, glabrous or the upper part with a few hairs or bearded or also pubescent. Racemes at length exserted from the lower half of the spatheole, before exsertion shorter than or scarcely exceeding the latter, at first appressed and even at maturity only slightly diverging (but not more than 40° and usually less), 15–20 (–30) mm long with 6–9 (–11) awned spikelets per pair (3–5(–6)-jointed); lowermost pair of spikelets of subsessile raceme rarely heterogamous. Joints and pedicels nearly equal, linear, flattened or concave on the inner side, slightly convex on the back, dilated at the cupshaped 2–3-lobed crenulate tip, 2·25–3 mm long, densely villous on the margins and over all or all except the lower part of the back (of both) which may be merely pubescent or even glabrous, the hairs elsewhere up to 4–5·5 mm long. Sessile spikelets narrowly oblong to narrowly elliptic-oblong, acute and somewhat acuminate, usually pallid, 4–6 mm long, 0·7–1 mm wide; 5–7 times as long as wide; callus hairs up to 1–1·3 mm long. Lower glume 2-keeled from about the middle, the keels scaberulous, not or very narrowly marginate (margin rarely as much as 0·3 mm wide), with 2–5 intracarinal nerves of which at least 2 are usually prominent nearly throughout and the central one if present is usually shorter, rarely extending downwards to the middle and sometimes uniting with a lateral below the tip, back flat in the upper part, ± concave to deeply furrowed in the lower half and sometimes pubescent in the furrow. Upper glume 3–5-nerved with narrowly marginate scaberulous keel. Lower lemma narrowly oblong, 2–3-nerved, shortly ciliate about the middle 2·4–4·2 mm long. Upper lemma bilobed to $\frac{1}{4}$–$\frac{1}{2}$ the length with linear or narrowly ovate ± acute lobes ciliate on both margins; awn 12–20 mm long, the column 4·2–7 mm long and $\frac{1}{3}$–$\frac{1}{2}$ the length of the awn. Anthers about 1·5–2 mm long. Grain oblong somewhat elliptic, obtuse, 2–2·2 mm long, 0·6–0·8 mm wide; embryo $\frac{1}{2}$–$\frac{3}{5}$ the length of the grain which is shallowly furrowed on the other side. Pedicelled spikelet male or neuter, ovate-linear, acute, 3·2–4·8 mm long, the callus with hairs up to 0·7 mm long. Lower glume with 7 intracarinal nerves, the keels scaberulous, the margins ciliate, convex on the back or involute. Upper glume up to more than half as long or absent. Lemma up to as long as the upper glume or absent. Fig. 6.

WESTERN AUSTRALIA.—Northern Province: Mulyie Stn., De Grey R., *Binning;* Dampier's Archipelago, Feb 1818, *A. Cunningham*, and in 1875, *Walcott;* Nickol Bay on the most elevated hills, *?;* Maitland R., SW of Roebourne, Feb 1962, *George* 3304; Mt Herbert, SE of Roebourne, Mar 1962, *George* 3495; between the Ashburton and Yule Rivers, *Clement;* Fortescue R., tableland, May 1878, *?;* and in 1896, *Cusack;* Millstream Stn., along creek, Sep 1969, *Brooker* 2137; Port Hedland, Aug 1905, *Staer,* and Apr 1905, *Fitzgerald* 79; 142 miles S of Port Hedland, Aug 1960, *George* 1081; Hamersley Railway Line between Mt Tom Price and Dampier, Oct 1968, *E. B. L. Smith;* Gorge Range, Warralong Stn., between boulders in rocky gully, May 1941, *Burbidge*

788; Kitty's Gap, E from Eginbah Stn., amongst boulders in stoney creek, Jun 1941, *Burbidge* 973, and between boulders on rocky slope, Jun 1941, *Burbidge* 981; Marble Bar, Feb 1938, *Stewart* in *Burbidge* 287; Camden Harbour, *?;* Edkins Range, Aug 1905, *Fitzgerald* 1436. Eremean Province: Austin District-Barrow I., Jun 1964, *W. H. Butler,* and 6 km W of landing, Jun 1964, *Goodall* 1558; 9 miles N of Learmonth, Aug 1960, *George* 1283; Cape Range-Charles Knife Rd., Aug 1960, *George* 1324; Cape Range, Aug 1960, *George* 1350, and Jun 1961, *George* 2476, and in limestone soil, May 1965, *George* 6550; Robe R. between Onslow and Roebourne, Aug 1966, *R. Butler* 26; Tagabina (?Togobinna Pool), Barbe Range, Sep 1959, *Robinson*: South Barbe Range, Sep 1959, *Robinson;* Jigalong, red sandy loam on creek bank, May 1947, *Royce* 1524; Carnarvon, *Barnett*: Thomas Stn., Gascoyne R., in 1898, *Binning;* Upper Gascoyne R., rocky banks of, in 1882, *Pollack;* Sturts Creek, *F. Mueller;* Islands of Sharks Bay, *Baudin;* Peak Hill, Jul 1926, *A. R. Walker;* near Mt. Hale, Upper Murchison R., Jan 1884, *Crossland;* "interior beyond the Murchison R.," *Monger;* N of Meekatharra, Jul 1931, *Gardner;* 6 miles E of Hillview Homestead, cracks of granite rock and around rock outcrops, Sep 1957, *Speck* 875; 15 miles E of Meekatharra, railway embankment, Mar 1959, *Speck* 757; Stake Well (S of Meekatharra), railway embankment, Apr 1951, *Humphries;* Barr Smith Range, granite rocks, *Gardner* 2417; Coodardy Stn., NW of Cue, Jul 1927, *Gardner;* Whalloo Rocks, Coodardy Stn., Sep 1968, *Main;* near Lake Austin, in 1886, *King;* Lake Austin, granite rocks, Jul 1931, *Gardner;* few miles S of Anketell H. S. which is E of Mt Magnet, Sep 1968, *Ashby* 2608; Wagga Wagga Stn., E. of Galgoo, Dec 1939, *Pearce;* near Paynes Find between Wubin and Mt Magnet, Sep 1938, *Blackall* 3876; Gwalia, Sep 1905, *Andrews 2nd Coll.* 94; Lake Darlot, Sep 1927, *Gardner & Blackall;* "Ninghan country" [between Lake Monger and Lake Moore], *Monger;* waterholes ± 4 miles N of Giles, Jul 1958, *Hill & Lothian* 828, 829; Laverton, Apr 1903, *Rowe,* and Aug 1909, *Maiden;* Dadyun Rockhole, ± 60 miles ENE of Laverton, Jul 1963, *George* 4582. Coolgardie District—Bonnie Rock, Sep 1957, *Main;* Elachbutting, Sep 1957, *Main;* Yilgarn near Mt Morre, in 1889, *King & Lefroy;* Wadderin Rocks, Sep 1947, *E. T. Bailey* 345. South-West Province: Irwin District—Near Barrel Well, Murchison R., *Oldfield* 235; Murchison R., in 1894, *Owen Daly;* Champion Bay, *Oldfield:* Murchison District—*Stoward* 184a; Yandanooka, in 1904, *Maddox;* Carnamah, Nov 1906, *Morrison.* Avon District—East sources of Swan R., in 1888, *Maxwell*: Swan R., *Drummond* 100; near York, in 1888, *Paton;* York, [Mar 1839] *Preiss* 1842; back road to Beverley, Aug 1939, *Blackall.*

NORTHERN TERRITORY.—Darwin and Gulf District: Darwin, in 1891, *Holtze,* and in dry *Eucalyptus* savannah, Aug 1950, *van Steenis* 17658; and in Jun 1954, *Hilton;* Port Essington, *Armstrong;* Oenpelli (12° 18′ S, 133° 4′ E,) common in areas of mixed open forest at base of sandstone scarp, Sep 1948, *Specht* 1082; Fog Bay, 12° 48′ S, 13° 21′ E, low flat headland with scattered *Pandanus* sp. and *Cycas* sp., 5–6 m, Aug 1946, *Blake* 16773; north of 15° S, May-Sep 1911, *Campbell;* Caranbirini Creek, 16° 17′ S, 136° 4′ E, rare in skeletal soil on side of sandstone hill with *Plectrachne pungens* and *Eucalyptus miniata*, Jun 1971, *Latz* 1427. Barkly Tableland District: 8 miles NW of Tennant Creek, stony truncated desert soil, Apr 1945, *Perry* 581; 1½ miles N of Tennant Creek, stony hard desert soil, *Perry* 539. Alice Springs District: Murray Downs Stn., flood-over area, in 1954, *Lothian* 463; The Devil's Marbles, in pockets of gravel among rocks, Apr 1970, *Must* 530; Old Hatches Creek, rare in gravel in creek in hills, Feb 1972, *Latz* 2217; Mt Doreen Station, 22° 20′ S, 131° 18′ E, common in skeletal soil, scree slope of granitic hill, Jan 1972, *Latz* 2018; Napperby Crk, dry sandy bed, Feb 1961, *McKee* 8569; Meyers Camp near Haasts Bluff, May 1911, *Hill* 193; Haasts Bluff, May 1911, *Hill* 182; Ormiston Gorge, common in rock crevices, May 1956, *Chippendale* NT.2096; Gosses Bluff Range (Gosse Range) near Hermannsburg, about Jul 1920, *Basedow*; Macdonnell Range, *Giles;* Mt Liebig, near watercourse amongst stones, Aug 1932, *Cleland* L.1, and in watercourse, Aug 1932, *Cleland* L.2; Hermannsburg, *Kempe* 142, and Mar 1911, *G. F. Hill* 70, and Aug 1929, *Cleland;* Palm Valley near Hermannsburg, Aug 1929, *Cleland* H.106, and Jun

1953, *Symon* 64; 30 miles W of Alice Springs, Aug 1932, *Fry in Cleland* L.3; Standley Chasm, rocky slopes of gorge, May 1953, *Perry* 3514 and Sep 1955, *Perry* 5373, 5390 and Oct 1955, *Perry,* and Jun 1953, *Symon* 60, and among rocks on floor of deep valley, Nov 1954, *Winkworth* 726, and on rocky ground, Nov 1954, *Chippendale* NT.525, and on the slope in sunny situations, Jul 1969, *Orchard* 824; near Alice Springs, May 1875, *Giles;* Macdonnell Range East, May 1875, *Giles;* Simpson's Gap, Jan 1927, *Cleland;* 4½ miles N of Alice Springs, infrequent in stony hills, Feb 1971, *Nelson* 2079; Alice Springs, Apr 1911, *G. F. Hill* 128, and Aug 1929, *Cleland* H.21, and Sep 1935, *Patton* 5 and Aug 1936, *Patton* 18; Alice Springs, in gullies, Jul 1922, *Allen* 551; Todd R. near Alice Springs, in sandy bed, May 1955, *Lazarides* 5322; Undoolya near Alice Springs, Jan 1927, *Cleland;* 6 miles S of Harts Range Police Stn., common in rock ledges near small watercourse, Jul 1957, *Chippendale* NT.3447; S side of Harts Range, 14 miles W of White Quartz Hill Outstation, Jun 1953, *Symon* 417; Mt Ultim, Sep 1930, *Cleland* H.87; 24 miles SSW of Lucky Creek Stn., dominating rocky creek bank with *Eucalyptus camaldulensis,* May 1955, *Lazarides* 5228; Mt Olga, Jun 1953, *Symon;* Ayers Rock, dominant in rock crevices in shallow sand, Oct 1956, *Lazarides* 6145; Ayers Rock, Jun 1935, *Cleland;* Petermann Ranges, ½ mile E of Ewalinga Rockholes, in creek bed at base of gorge, Sep 1969, *Maconochie* 779.

SOUTH AUSTRALIA.—Far North West: Rockhole 10 miles N of Ernabella, Musgrave Ranges, Aug 1933, *Cleland;* Ernabella, common in all the ranges, Dec 1932, *Finlayson,* and Aug 1933, *Cleland*: Musgrave Ranges, Porcupine Hill by Mt. Harriet Road, Oct 1966, *Weber* 186; Mt Harriet near the waterhole at the foot of the southern side of the mountain, Sep 1963, *Eichler* 1725; Camp 14 [near Mt Watson], on granite range, Jul 1891, *Helms;* near Camp 8 [± 90 km ESE of Mt Lindsay], May 1891, *Helms;* Everard Ranges, hillside, Sep 1968, *Spooner* 64A; at Ungulbullarinna Rock Hole, Sep 1963, *Whibley* 1130, and 25 km WSW of Everard Park homestead, Sep 1963, *Whibley* 1178. Lake Eyre Basin: vicinity of Lake Eyre, *Andrews* 172; Finniss Springs, Dec 1926, *F.D.W. comm. J. M. Black,* Sep 1951, *Cleland,* Oct 1947, *Cleland.* Eyre Peninsula: Yudnapinna Stn., Aug 1938, *Davies,* Nov 1938, *Douglas,* Nov 1952, *L.V.B.,* Jul 1954, *Hilton* 845, in stony creek bed, Oct 1939, *H.M.D.,* bank of dry creek, Sep 1946, *Burbidge;* near Cariewerloo Stn., Mar 1950, *Gross.* Flinders Range: without further locality, in 1890, *Molineux;* Callanna Stn., in 1914, *Fabian;* Mt. Norwest Stn., Jul 1955, *R. Hill* 49; halfway between Avondale and Lyndhurst, Apr 1955, *Hilton* 1353; Mt Lyndhurst, Nov 1898, *Koch* s.m. and Apr 1955, *Hilton;* ca 16 km NW of Leigh Creek, Sep 1962, *Lothian* 1067; Mt Parry Gap, Jun 1883, *Tate;* about 16 km S of Arkaroola homestead, Oct 1971, *Kuchel* 2916; Paralana Hot Springs, Aug 1963, *Kuchel* 927; Myrtle Springs Gorge (south banks) ± 20 km W of Leigh Creek, rocky cliffs, Nov 1964, *Lothian* 3323; Italowie Gorge, ± 30 km E of Copley, creek bed, Sep 1963, *Lothian* 2524; Nepabunna, May 1937, *Cleland;* near Nepabunna, Jun 1937, *E. C. Black;* Balcanoona Stn., Apr 1955, *Kerr;* Mt Chambers Gorge near Mt Chambers, Sep 1956, *Eichler* 12595; Mt Chambers Gorge, Oct 1960, *Filson* 3471; Red Gorge, Deception Ck, Oct 1962, *Kraehenbuche* 757; N of Wirrealpa Stn., in creek bed, Oct 1955, *R. Hill* 386; Salt Springs, Wirrealpa Stn., Oct 1946, *Cooper;* near the Guardians, Brachina Gorge, Oct 1959, *E. N. S. Jackson* 162; Brachina Gorge, Oraparinna National Park, *Weber* 2570; Mernmerna, Oct 1968, *Weber* 724; Wilpena Pound, Nov 1928, *Cleland;* Elders Range, western side, near Mt Aleck, Dec 1952, *Gross;* Willochra, Nov 1927, *J. M. Black;* Salteyer Ck, Oct 1851, *Mueller;* Mt Brown, Nov 1851, *Mueller;* Melrose, Jan 1921, *Andrews;* near Melrose, *Tepper* 160; Alligator Gorge, SE of Port Augusta, Dec 1967, *Blaylock* 843; ca 1 km in from west entrance to Port Germein Gorge, Dec 1966, *Copley* 1031; Port Germein Gorge, Dec 1969, *Alcock* 3207; Crystal Brook, Nov 1851, *F. Mueller.* East Coast, St. Vincents Gulf: Halletts Cove, Jan 1949, *L. D. Williams* 241. Adelaide Plains: Campbelltown, on a clay bank of Torrens R., Aug 1970, *Spooner* 608. Mt Lofty Range: Hallett, Nov 1938, *Cleland;* Little Para R., Golden Grove, *Tepper;* Golden Grove, Nov 1884, *Tepper* 1174; South Para, Jan 1903, *Koch* 59; Torrens Gorge, western part, along roadsides, Sep 1969, *Spooner* 540, Feb 1970, *Spooner* 541, Mar 1972, *Spooner* 1820;

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Clarendon, among rocks, May 1882, *Tepper* 781; Onkaparinga R. at Noarlunga, Apr 1940, *Cleland.* Far Eastern Section: Koonamore Stn., Oct 1963, *R. Hill* 1220, creek bed, *Carrodus,* sandy creek bank, Feb 1972, *Crisp* 428; Quandong Stn., in watercourse, Apr 1967, *S. Barker* 135. Murray Mallee: Sutherlands, among rocks in the Deep Creek, Nov 1932, *Boehm;* waterfall near Mannum, Apr 1924, *Cleland.*

QUEENSLAND.—Cook District: Without further locality, *Pollock;* Thursday I., Jun 1885, *Bauerlen* 6; Cooktown, on Grassy Hill, among granite boulders, with scattered to clustered trees or shrubbery, May 1962, *Blake* 21847; Mount Molloy, dry stony ridges, 360 m, Apr 1932, *Brass* 2545, and dry stony hillsides, Apr 1932, *Brass* 2464; Mount Surprise, on top of Mt Surprise among quartz boulders, ± 560 m, Aug 1943, *Blake* 15097; Etheridge R., *Armit* 1011. Burke District: 12 miles E of Lawn Hill Stn., shallow soil on limestone with *Bauhinia cunninghamii,* Jun 1948, *Perry* 1415; Riversleigh Stn., approx. 19° 0′ S, 138° 45′ E, on stony ground, Apr 1935, *Blake* 8643; 10 miles N of Mt Isa, common on slopes of quartzite hill, with *Eucalyptus brevifolia* and *Triodia burkensis,* Aug 1954, *Lazarides* 4803. Gregory North District: Duchess, in rock crevices on low rugged hill ca 390 m, May 1936, *Blake* 11530; Mt Aplin, 20 miles ENE of Dajarra, common on top and lower slopes of rocky hill, Sep 1953, *Lazarides* 4067. North Kennedy District: Cashmere, Mar 1875, *Armit* 169; Rockingham Bay, Apr 1871, *Dallachy;* Palm I., Apr 1931, *Bancroft* and Jun 1931, *Bancroft;* Townsville, on Castle Hill, in rocks, Feb 1910, *Domin* and on rocky slopes, 240 m, Jan 1931, *Hubbard & Winders* 6619A, and Mar 1935, *Blake* 8168, and on Castle Hill, common on foothills and almost to summit, Jul 1938, *Goy* 376; Magnetic I., Mar 1922, *White* 1633, and on low sandy ridges in *Eucalyptus* forest, Mar 1935, *Blake* 8215, and between Alma Bay and Horseshoe Bay, very common along road, Jul 1938, *Goy* 343; Cleveden, rocky hills, Mar 1934, *White* 8851; 7 miles SW of Pentland, common on sandy yellow podsolic soil with *Eucalyptus setosa, E. similis* and *E. shirleyi,* Jun 1953, *Lazarides* 3582; Ravenswood, among granite boulders in stunted *Eucalyptus* forest on sandy soil, ca 300 m, Mar 1943, *Blake* 14872; Hayman I., fairly common on hillsides in open *Eucalyptus* forest, Jun 1934, *White* 10220; Hook I., common in rock crevices near the sea, Jun 1937, *Goy* 154; hills about Proserpine, May 1935, Trotter. Leichhardt District: Clermont, Mar 1927, *White* 3469; Peak Downs, *?; Minerva,* N of Springsure, on exposed rugged trachyte hillside, 360–390 m, very common, Mar 1935, *Blake* 7964. Port Curtis District: Mt Wheeler, *Thozet.*

NEW SOUTH WALES.—Far Western Plains: 2½ miles S of "Corona", in dried creek bed, red soil, Apr 1970, *De Nardi* 445; Barrier Range, in 1889, *Irvine;* Silverton, Aug 1939, *Pidgeon & Vickery;* Broken Hill, bed of rocky creek, Oct 1920, *A. Morris* 411; Stephens Ck, Broken Hill, bank of stony creek, Jan 1921, *A. Morris* 401, 502; Torrorangee, Nov 1900, *Assistant Forester;* [Nootoombulla Ck, 7–8 miles N of Mootwingie], Feb 1861, *Beckler;* Mootwingie, Oct 1921, *A. Morris* 847; 56 miles NNW of Wilcannia, in bed of dried-up creek, on red sandy soil, common in damp places, May 1969, *De Nardi* 268; Wilcannia, in 1885, *Kennedy;* Mt Lyell, *Kennedy* in 1886. Central Western Slopes: near Dubbo, in 1882, *Curran.*

Also in Timor (Portuguese Timor, Plateau of Baucau, limestone karst, common in burned *Eucalyptus alba* forest, ± 350 m, Dec 1963, *van Steenis* 18577—see Blake loc. cit.).

This species was referred to *C. exaltatus* by Bentham, Hackel and Domin, but Brown's specimens of this are conspecific with *C. procerus* differing only from his specimens of the latter in having usually 2 intra-carinal nerves instead of none (see under *C. procerus*). *A. lanatus* R. Br. treated as a variety of their concept of *A.* (*C.*) *exaltatus* by Hackel and Domin must be treated as a synonym of *C. bombycinus* (see under this), but Bentham had applied the name to states of *C. ambiguus.* Hackel cited a manuscript name of Mueller's, but Fragm.

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8:124 (1873) did not distinguish this from *A. bombycinus* and *C. lanatus* referring all to the African—Arabian *A. laniger* Desf. which is *C. schoenanthus* (L.) Spreng. (see under *C. bombycinus*). The species was figured and described in Ic. Pl. 29:t.1689 (1889) by Hackel under the name of *Andropogon (Cymbopogon) exaltatus* var. *ambiguus* and Hackel stated that the figure was drawn from *Drummond* 100 but the leaves are very much broader. The type of *Cymbopogon exaltatus* var. *gracilior* is a specimen with a reduced inflorescence.

I have not seen a specimen actually labelled by Steudel but there are three and possibly four at P, two at S, and one in BM that must be isotypes. The labels to all have some reference to the west coast of New Holland, some to Baudin's Expedition, 1801; one (P) has the further locality "Isles steriles", with a slit label with "No 141", another (P) has "Plage du geographe" and the BM sheet has "cote ouest de la Nlle hollande—iles steriles/ou de dorres 1801" with a later label "Nov. Holl. or. occident./Isles steriles/Herb. Mus. Paris/Sepr 1826". The date here presumably refers to the date of distribution and Steudel's citation "Ex hrbo. Mus. Paris. N. Holl." must be an abbreviation of this label. The "Iles steriles" are Bernier I. and Dorre I. in Shark Bay, Western Australia.

C. ambiguus is the most widely distributed species of the genus in Australia and is found from the arid interior to the tropical coast, commonly on rocky outcrops. Especially in the drier parts of the continent many plants including the type have extremely narrow canaliculate leaves reduced almost to the midrib but such narrow leaves and much broader leaves are often found on the same plant. Some leaves on Pearce's specimen from Wagga Wagga Stn., Western Australia are unusually narrow, some only 0·3–0·4 mm wide or 0·8 mm when expanded. The lower glume of some sessile spikelets on Gardner and Blackall's collection is 6-nerved. A few specimens have the lower glume dark-coloured. Occasionally the lowermost pair of spikelets of the subsessile raceme may be heterogamous.

4. Cymbopogon bombycinus (R. Br.) Domin, Biblioth. Bot. 85:274 (1915); S. T. Blake, Proc. Roy. Soc. Qd. 80:70 (1967). Combination made independently by A. Camus, Rev. Bot. Appliq. 1:290 (1921). Based on *Andropogon bombycinus*.

Andropogon bombycinus R. Br. Prodr. 202 (1810). Type: "East Coast" [Upper Head, Broad Sound = Charon Point] *R. Brown* [6175] (BM, holo; K, BRI, MEL, P.).

Andropogon lanatus R. Br. Prodr. 202 (1810); S. T. Blake, Proc. Roy. Soc. Qd 80:70 (1969). Type: [Nothern Territory, Pobassoo I.] *R. Brown* [6174] (BM, holo; E, K, W).

Andropogon procerus R. Br. var. *schultzii* Hack. in DC. Monogr. 6:595 (1889). Type: Port Darwin, *Schultz* 60 (W, holo; K).

Andropogon exaltatus R. Br. var. *lanatus* (R. Br.) Hack. in DC. Monogr. 6:596 (1889). Based on *A. lanatus.*

Sorgum bombycinum (R. Br.) O. Kuntze, Rev. Gen. Pl. 2:791 (1891). Based on *Andropogon bombycinus.*

Cymbopogon procerus (R. Br.) Domin var. *schultzii* (Hack.) Domin, Biblioth. Bot. 85:273 (1915). Combination made independently by A. Camus, Rev. Bot. Appliq. 1:289 (1921). Based on *Andropogon procerus* var. *schultzii.*

Cymbopogon exaltatus (R. Br.) Domin var. *lanatus* (R. Br.) Domin, Biblioth. Bot. 85:273 (1915). Combination made independently by A. Camus, Rev. Bot. Appliq. 1:290 (1921). Based on *Andropogon lanatus.*

Cymbopogon bombycinus (R. Br.) Domin var. *townsvillensis* Domin, Biblioth. Bot. 85:275 (1915). Type: Queensland, Castle Hill near Townsville, *Domin* (PR holo; K).

Cymbopogon lanatus (R. Br.) Roberty, Boissiera 9:175 (1960). Based on *Andropogon lanatus.*

Cymbopogon schultzii (Hack.) Roberty, Boissiera 9:175 (1960). Based on *Andropogon procerus* var. *schultzii.*

Cymbopogon nardus (L.) Stapf subvar. *bombycinus* (R. Br.) Roberty loc. cit. 173.

Cymbopogon nardus (L.) Stapf subvar. *lanatus* (R. Br.) Roberty loc. cit. 175.

Cymbopogon nardus (L.) Stapf subvar. *schultzii* (Hack.) Roberty loc. cit. 176.

Culms erect, about 40–120 cm long; mostly 2–3-noded beneath the inflorescence, the internodes smooth or (particularly the uppermost) scabrous towards the top, commonly ± densely pubescent close below and at the nodes or some glabrous, often also ± pruinose at and near the nodes. Leaf-sheaths often ± scaberulous on the nerves in the upper part, those on the culm glabrous and often longer than the internodes, the basal ones pubescent, long persistent at length becoming flat up to 6 mm wide and recurving; orifice glabrous or with a few long hairs; collar glabrous or puberulous or with a few longish hairs; ligule 2–6·5 mm long; blades ± flexuose, ± scaberulous beneath, smooth or nearly so above or somewhat scaberulous on some veins, folded to flat or with recurved margins, with 2–3 pairs of primary lateral veins, about 15–40 cm long and 0·9–4 mm wide. Panicle occupying about $\frac{1}{5}$–$\frac{1}{2}$ the length of the culm, ± narrowly oblong, dense or the longer ones interrupted below, densely woolly, mostly 4–8-noded, branched to the second, sometimes only the first degree, about 6–40 cm long about 3–6 cm wide; internodes of axis compressed-angular, scabrous upwards, ciliate just below the ± densely pubescent to bearded nodes;

branches 1–3 together, erect, mostly exceeding the internodes. Spatheoles at length reddish, very narrowly ovate, pubescent towards base and on hyaline margins, somewhat scaberulous on the nerves, 25–35 mm long, about 5–6 mm wide when flattened. Peduncles filiform, pilose upwards, 5·5–11 mm long about ¼–⅖ as long as the spathe. Racemes before exsertion from shorter than to a little longer than the spatheoles, then exserted from the lower ¼–⅖, at length divergent very rarely ± reflexed, densely woolly 12–18(–22)mm long, 3–5-jointed; joints and pedicels subequal, the latter if anything shorter (by up to 0·3 mm), linear, flattened or concave vertically, slightly convex on the back, slightly dilated below the unequally lobed crenulate cup-shaped tip, 2·2–3·8 mm long, about ⅔–¾ as long as the sessile spikelet, densely villous all over margins and back and also in front at least in the upper part, the hairs as long as to very much longer than the joint, up to 6 mm long and completely concealing the sessile spikelets. Sessile spikelet very narrowly ovate to ± obovate, acute, often somewhat acuminate, 4–6 mm long, 0·7–0·8 mm wide; callus bearded with hairs up to nearly as long as the spikelet. Lower glume 2-keeled almost throughout, with the margin inflexed from about the middle, the keels scarcely marginate, scaberulous in upper part, in the dry state commonly converging below the middle and then diverging shortly above the base, with 1–2 short intracarinal nerves in the upper part or these quite absent, the back flat or nearly so in the upper part, ± deeply concave or furrowed between the keels below, glabrous to densely pubescent on back and sides, often somewhat pubescent inside in upper part. Upper glume 3- or sub–5-nerved; keel ± distinctly marginate, at least the sides ± pubescent. Upper lemma bilobed to ¼–⅓ with narrowly ovate acute lobes, 3-nerved towards base, about 3·3–3·5 mm long; awn imperfect or perfect, 6–21 mm long, the column when present up to 5 mm long. Anthers 1·3–2 mm long. Grain somewhat elliptic about 2·4 mm long and 1 mm wide; embryo ⅗ as long as grain. Pedicelled spikelets male or neuter, very narrowly ovate or linear ovate, 3·4–5·4 mm long, about 0·8–1 mm wide; callus hairs up to 1·2 mm long. Lower glume with 7 intracarinal nerves, slightly to strongly convex. Upper glume shorter, 3–5-nerved. Lower lemma still shorter up to about ⅓ as long as the lower glume. Fig. 8.

WESTERN AUSTRALIA.—Northern Province: Between the Ashburton and De Grey Rivers, *Clemont;* Port Hedland, Apr 1905, *Fitzgerald* 79; King Sound, *Froggatt;* Derby, Apr 1905, *Fitzgerald* 175; near Derby, in 1898, *Hann;* Balmaningarra, Apr 1916, *Basedow* 4 N.W., 106 N.W.; Camden Sound, May 1921, *Gardner* 1333; Edkins Range, Aug 1905, *Fitzgerald* 1456; Isdell R., Jul 1905, *Fitzgerald* 1141; Mt House Stn., *Blythe* 27; King Edward R., Aug 1921, *Gardner;* Karungie Stn., irrigation plot, Jul 1952, *Lazarides* 3148; Cambridge Gulf, in 1886, *J. Forrest;* Kimberley Research Stn., light sandy soil, *Langfield* 218; 7 miles E of Denham River Stn., with *Eucalyptus tectifica* and *Sehima nervosum* on skeletal volcanic soil, Jul 1949, *Perry* 2530; near Ord R., in 1886, *O'Donnell;* Ord R., Apr-May 1945, *K. M. Durack;* 3 miles E of Springvale Stn., occasional on stony skeletal soil on granite with *Eucalyptus brevifolia* and *Enneapogon polyphyllus,* Apr 1955, *Lazarides* 5064.

NORTHERN TERRITORY.—Darwin and Gulf District: Port Darwin, *Schultz* 60, 150, 187, *Giles* 56; Darwin in 1880, *Holtze* 126, and on rocky ground, Feb 1920, *Allen* 457 and Mar 1945, *Cantor,* and on aerodrome, *Eucalyptus* savannah, 10 m, Aug 1950, *van*

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Steenis 17652; Stuart Highway, 14 miles E of Darwin, rare on gravelly sand in open *Eucalyptus* forest, Mar 1964, *Adams* 905; north coast of Arnhem Land, *McKinlay;* Pobassoo Is., English Company's Is., Feb 1803, *R. Brown* [6174]; near Brocks Creek, open *Eucalyptus* forest in stony places, Jul 1946, *Blake* 16322; 5 miles N of Katherine near Darwin Road, red sandy soil on limestone, May 1952, *Lazarides* 2772; 5 miles N of Katherine, limestone pavement country with red soil, Feb 1961, *McKee* 8524; Katherine, Mar 1943, *Bake* 10; Nott's Crossing, Katherine, sandy levee of river, Jan 1965, *I. B. Wilson* 195; Katherine Expt. Stn., grass paddock with *Heteropogon* etc., not abundant, Mar 1946, *Hartley* Hb. 11771; near headwaters of Flora R., approx. 54 miles SW of Dorisvale Stn., May 1952, *Lazarides* 2817; 44 miles SW of Katherine, on slope to flat-topped hill, Jun 1949, *Perry* 2003; 8 miles SE of Larrimah, Mar 1955, *Winkworth* 1093; Daly Waters, lateritic clay loam, Mar 1972, *Byrnes* 2565; near Tanumbirini, sandstone ranges, Mar 1912, *Hill* 811; headwaters of McArthur R., 16° 55′ S, 135° 43′ E, open stunted forest of *Eucalyptus brevifolia* on stony hillside with *Plectrachne* sp., 137 m, May 1947, *Blake* 17770; 10 miles W of Borroloola, rare on sandy loam below sandstone hill, Jun 1971, *Latz* 1465; 30 miles E of Borroloola with *Callitris intratropica* and *Eucalyptus ferruginea* on sandy lateritic soil, Jul 1948, *Perry* 1843; Settlement Ck, Feb 1922, *Brass* 133. Victoria River District: 14 miles SW of Birrimbah Outstation, on lateritic podsol with *Eucalyptus brevifolia* and *Chrysopogon* sp., Jun 1949, *Perry* 2059; 30 miles ESE of Limbunya Stn., on steep dissection slope from Tertiary lateritic mesa with *Eucalyptus brevifolia,* Jun 1949, *Perry* 2299; 30 miles SSW of Wave Hill Stn., near edge of truncated lateritic desert, Jun 1949, *Perry* 2210; Sturt Ck, *Mueller;* 7 miles SSW of Inverway Stn., on desert fringe, Jul 1949, *Perry* 2353. Barkly Tableland District: Banka Banka, porphyritic rock, Jul 1922, *Allen* 665; 52 miles N of Tennant Creek, valley between quartzite hills, Apr 1948, *Perry* 632; 25 miles N of Brunette Downs Stn., desert soil with *Ventilago viminalis,* Jul 1948, *Perry* 1607; 90 miles WSW of Lake Nash Stn., stony hills, May 1948, *Perry* 911. Alice Springs District: Macdonnell Ranges, *Stuart;* Alice Springs, in trucking yards, Jun 1949, *Rose.*

QUEENSLAND.—Without definite locality in 1770, *Banks & Solander.* Cook District: "Rutland Plains" near mouth of Mitchell R., *Whitehouse;* Laura, savannah forest, ± 150 m, Aug 1948, *Brass* 19989; Palmer R., in 1880, *Wycliffe* 58; on Wrotham Park Stn., ± 50 miles NW of Mungana, in open forest, Apr 1938, *Blake* 13675; Mungana, Jun 1912, *E. C. Black;* Walsh Range, *Burton;* Chillagoe, on granite hill slopes, ± 435 m, Apr 1938, *Blake* 13633; near Chillagoe, Jan 1910, *Domin*; at the foot of Calcifer Bluff, Jan 1910, *Domin;* Mt Molloy, dry stony hillside, 360 m, Apr 1932, *Brass* 2463; Gorge Ck, 10 miles W of Mareeba on Dimbulah road, in crevices on granite rocks, 400 m, May 1962, *McKee* 9470; head of Emu Ck, S of Irvinebank, Mar 1962, *Whitehouse;* Watsonville, *Gallogly;* Gilbert River, Mar 1925, *Brass* 436, *Pollock* 25, 26 and *Wildash;* Forest Home Stn., on sandy ridges, Mar 1931, *Brass* 1835; Cumberland, sporadic on granite ridges, May 1937, *Brass* 8829. Burke District: Carpentaria, in 1877, *Hann*: Mornington I., Aug 1966, *Woolston;* Sweers I., Jun 1901, *J. F. Bailey;* 6 miles W of Westmoreland Stn., on poorly drained lateritic flat with *Melaleuca,* Jun 1948, *Perry* 1315; "Abel's Grove" [NNW of Camooweal], hillsides and stony ridges, Mar 1947, *de Lestang* 334; and rocky hillsides, Mar 1950, *de Lestang* 447; Mt Isa, among *Triodia* spp. chiefly in rocky gullies between the hills, 375 m, Apr 1935, *Blake* 8796; Mt Isa, Apr 1953, *Foster;* Cloncurry single clump in crevice in rock near the summit of Black Mtn, Feb 1937, *Everist & Smith* 224; near Cloncurry on a hill, Feb 1910, *Domin*; 200 miles W of Hughenden [= near Cloncurry], Aug 1889, *J. Chisholm;* Doomadgee Mission near Burketown, Jun 1943, *Whitehouse;* Donors Hill, May 1967, *Symon* 4974; Magoura Stn. near Normanton, *Banham;* Normanton, Mar 1867, *Gulliver;* Normanton, on fine sand generally, May 1935, *Blake* 8947; between the Norman and Gilbert Rivers, in 1874, *Gulliver* 36; near source of Poison Creek, about 90 miles N of Hughenden, in *Eucalyptus-Callitris* forest on compact sand, 780 m, Apr 1935, *Blake* 8490; Flinders R., *Armit* 1073. Mitchell District: Torrens Creek, Aug 1933,

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Chisholm. North Kennedy District: 19 miles E of Mount Garnet in mixed *Eucalyptus* woodland savannah, gravelly podzolic soil, May 1967, *Symon* 4892; 4 miles N of Conjuboy Stn. [± 18° 35′ S, 144° 45′ E], occasional on red stony soil on basalt with *Eucalyptus polycarpa,* Feb 1954, *Lazarides* 4189; Herbert R., ? 25; Acheron Isle occasional on very shallow rocky soils (granitic), Jul 1966, *Birch* I/142, and on cliff edge, windward side, not common, Jul 1966, *Birch* I/136; Bay Rock, Jun 1969, *Firth;* Townsville, *Pollock,* and Apr 1950, *Grant,* and on Castle Hill, Feb 1910, *Domin* and Jan 1931, *Hubbard & Winders* 6619b, and on exposed slopes of Castle Hill on sandy soil, Jun 1934, *Blake* 5943; near "Greenvale" ± 19° S, 145° E, upper stony slopes of low hill in *Eucalyptus* forest with undergrowth, ± 480 m, Jul 1954, *Blake* 19459; Mt Remarkable near Pentland, Feb 1910, *Domin,* and on rocky slopes, Jun 1934, *Blake* 6123; near Pentland in dry forest, Feb 1910, *Domin,* and on hillsides in *Eucalyptus* forest, 390 m, May 1934, *Blake* 6079, and on more or less stony hillsides in mixed open forest, c. 390 m, Apr 1935, *Blake* 8381; Pentland, *Parker;* Port Denison, *Fitzalan.* South Kennedy District: 20° 58′ S, 146° 26′ E, 60 miles S of Charters Towers on road to Clermont, in spinifex country, sandy soil, Apr 1969, *B. Walker;* 1 mile N of Cerito Stn., frequent on fine gravelly sand on sandstone, with *Eucalyptus brownii* and *Casuarina luehmannii,* May 1964, *Adams* 969. Leichhardt District: 60 miles SW of Nebo, occasional on stony outcrop in *Acacia bancroftii-Heteropogon* woodland, Jun 1962, *Story & Yapp* 38; Coppermine, in 1871, *Slatter;* Peak Downs, *Burkitt;* Emerald, Feb 1908, *R. Simmons;* "Sandhurst Park" Fernlees, Jul 1934, *Garvey* O.S.P. 92; Minerva, N of Springsure, midslopes of rocky trachyte hill, 360–390 m, Jul 1934, *Blake* 6973, and on exposed rugged trachyte hillsides, 360–390 m, very common, Mar 1935, *Blake* 7963; crest of Zamia Range, ± 3 miles NNW of Springsure, very shallow soil, Mar 1960, *Johnson* 1400; Springsure, *F. M. Bailey;* 9 miles E of "Mantuan Downs", red gravelly ridge, Apr 1946, *Everist* 2528; Blackdown Tableland, along creek at base of Tableland, 210–240 m, Sep 1959, *Johnson* 1025. Port Curtis District: Pine Islet, Feb 1971, *Heatwole;* Middle Percy I., common on skeletal slopes with *Melaleuca viridiflora,* Feb 1960, *Lazarides* 5633; South Percy I., rocky country, Mar 1906, *Tyron;* near Upper Head [=Charon Point], in lowlying meadows, Sep 1802, *R. Brown* [6175]; near W coast of Shoalwater Bay, approx. 22° 26′ S, 150° 17′ E, in *Eucalyptus-Melaleuca-Xanthorrhoea* forest on gravelly ridge, Apr 1945, *Blake & Webb* 15609; Mt Wheeler, *Thozet* 535; Emu Park, in open rocky places, Mar 1935, *Blake* 7877; between Rockhampton and Westwood, Feb 1927, *White* 3391; Mt Morgan, very common in rock crevices on hill-top, not seen on flats, Jul 1938, *Goy* 302; Curtis I., Cape Capricorn, May 1966, *Alcorn;* Gladstone, Dec 1864, *Dietrich* 433, Jan 1865, *Dietrich* 1235, Dec 1865, *Dietrich* 1322 and Jul 1920, *White,* and in railway enclosure ± 5 m, Mar 1937, *Blake* 12800; Banana–Biloela Road, Jan 1956, *Burne;* S of Thangool, cleared edge of monsoon forest, May 1956, *Blake* 19989. Warrego District: Mt Brandon Stn., approx 25° 15′ S, 147° 30′ E, on rocky sandstone slopes ca 600 m, Apr 1936, *Blake* 11156. Burnett District: Mundubbera, Apr 1931, *Bloxsome* 12; "Narayen", Mundubbera, Nov 1966, *Tothill* N49; "Brian Pastures", near Gayndah, hilltop in *Eucalyptus* forest, coarse sandy soil, ± 200–210 m, Mar 1952, *Blake* 18914; "Brian Pastures", Feb 1959, *Schoneveld* 59. Wide Bay District: Mt Perry, *Keys.* Darling Downs District: near Gurulmundi, in 1930, *Belson;* Gowrie, *Bailey.*

Brown distinguished *A. lanatus* from *A. bombycinus* by the sessile spikelet having two instead of one intracarinal nerves and somewhat longer awns. On his material, these differences can be seen, but a closer examination shows that the intracarinal nerves of *C. lanatus* are short and there is sometimes only one present, and there is sometimes a second one present on *C. bombycinus.* Other collections show variation in the awns, these sometimes being less developed than on the type of *C. bombycinus,* and intracarinal nerves vary from 0–2. Bentham and Hackel both misunderstood *B. bombycinus,* misapplying the name to *Cymbopogon* *obtectus* and Hackel described the species as *A. procerus* var. *schultzii* referring it to *A. procerus* because of the nervation of the lower glume. At the same time both also misinterpreted *A. exaltatus* and *A. lanatus,* though Brown's specimens were cited. Bentham treated *A. lanatus* as distinct referring to it the broad-leaved and more woolly specimens of *C. ambiguus* and Hackel treated it as a variety of the former which both misidentified with *A. ambiguus* Steud. Domin partly followed Hackel's treatment but the specimens he cited under *C. bombycinus* rightfully belong here. *C. bombycinus* var. *townsvillensis* was based on small stunted plants, and he referred Clement's specimen to *C. procerus.* F. Mueller, Fragm. Phytogr. Austr. 8:124 (1873), referred *A. bombycinus* and *A. lanatus* to *A. laniger* Desf. which is true *C. schoenanthus* (L.) Spreng., and he included in his concept also specimens here referred to *C. ambiguus* and *C. obtectus. C. schoenanthus* differs sharply from all in having the pedicel of the homogamous pair of the base of the sub-sessile raceme much swollen and glossy.

C. bombycinus and *C. obtectus* are the only species that I have seen with the joints and pedicels villous on the inner side as well as the back and margins and *C. bombycinus* is the only Australian one with regularly pubescent spatheoles though the pubescence is not always obvious and tends to disappear with age. The racemes are commonly slightly divergent but sometimes are reflexed. Especially when dry the keels of the lower glume of the sessile spikelet converge towards the base and then diverge to the base itself, but this inbending tends to disappear on wetting. The broad flat recurved persistent old basal leaf-sheaths give a characteristic appearance to the plants.

The usual habitat is in *Eucalyptus* forest in association with other grasses on sandy or stony soils.

Blake 13633 has very narrow leaves but a well developed awn; *Allen* 665 has the upper lemma entire; K. M. Durack's specimen from the Ord River consists of two sheets one with an inflorescence (? complete) almost 50 cm long and 14 cm wide the other with three partial panicles 28–32·5 cm long and must have been taken from an unusually tall plant; *Blake* 11156 has the lower spatheoles glabrous or nearly so and the callus with unusually short hairs only 2 mm long.

5. Cymbopogon obtectus S. T. Blake, Univ. Qd. Pap. Dept. Biol. 2(3):55 (1944). Type: Queensland, W of Winton, *Blake* 6517 (BRI 010799, holo; K).

Culms erect, straight or slightly geniculate at base up to 100 cm long, 1–2– or rarely 3-noded below the inflorescence, glabrous, smooth. Leaf-sheaths scaberulous or nearly smooth those of the culm leaves shorter than the internodes, the basal ones at length ± loose, the lowermost densely silky the upper ones persistent, straight and ± inrolled all along, or ± flexuous, flattened and 2–3 mm wide; collar glabrous or pubescent; ligules 3–5 mm long; blades rounded at the base and there ± thickened, folded or flat, densely scaberulous on the margins and lower surfaces, smooth above, with long hairs behind the ligule, pubescent at the base beneath especially on the cauline leaves elsewhere glabrous with 2–4 pairs of nerves, up to 35 cm long, 1·25–2·5 mm wide. Panicle occupying about $\frac{1}{5}$–$\frac{1}{3}$ of the culm, oblong or narrowly oblong, densely woolly, usually dense and continuous, about 3–5-noded, 7–25 cm long, 3–4 cm wide, branched to the second degree; internodes of axis ± bearded at nodes and pubescent and ciliate for a short distance below; branches 1–4 or more together, about equal to or shorter than the internode, up to 3-noded, bearded at and below the nodes. Spatheoles ± narrowly elliptic or narrowly ovate-elliptic, scaberulous on the back, glabrous, 20–32 mm long, 6–10 mm wide. Peduncles bearded below the tip, 5–10 mm long, about $\frac{1}{4}$–$\frac{1}{3}$ as long as the spatheole. Racemes (with peduncles) before exsertion about as long as to distinctly longer than the spatheole, ± divaricate and soon epinastically reflexed, 15–25 mm long, 4–7-jointed, densely woolly; joints and pedicels subequal in length (one or the other up to 0·5 mm long), 2·75–3·5 mm long, about $\frac{3}{5}$ as long as the sessile spikelets, subequal, linear, dilated below the irregularly lacerately lobed cup-shaped tip, concave ventrally, back convex and together with the front and margins densely villous all over with hairs increasing in length upwards to 4·5–7 mm. Sessile spikelet narrowly elliptic or narrowly oblong-elliptic-ovate or somewhat obovate, gradually acute, 5·2–6·5 mm long, 1–1·2 mm wide; callus densely bearded with hairs up to 3·5 mm long, sometimes up to 5 mm long. Lower glume 2-keeled almost throughout, ± marginate from about the middle sometimes prominently so and the margin up to 0·15 mm wide, with 2–5 intracarinal nerves, the outermost or only pair prominent usually percurrent to the tip from below the middle the others shorter, flat on the back in the upper part, deeply concave or prominently furrowed between the keels in the lower half or more, glabrous. Upper glume 5–7-nerved, the keel marginate to narrowly winged in the upper part. Lower lemma oblong or narrowly somewhat ovate, 2–3-nerved. Upper lemma linear to narrowly obovate, 1-nerved or 3-nerved at base, bilobed to $\frac{1}{6}$–$\frac{1}{3}$ the length with narrowly ovate lobes, 3·6–4·5 mm long; awn imperfect or perfect, 6–8 mm long, the column if present, up to 2 mm long. Anthers 1·7–2 mm long. Grain narrowly elliptic-oblong or narrowly elliptic, 2·75–3 mm long, 1–1·1 mm wide, the embryo $\frac{1}{2}$–$\frac{3}{5}$ as long as the grain. Pedicelled spikelets neuter, narrowly ovate acute, 3·5–5 mm long; callus bearded with hairs up to 1–1·5 mm long. Lower glume with 7–9 intracarinal nerves. Upper glume up to 3·4 mm long or absent. Lemma up to 2 mm long or absent. Fig. 7.

WESTERN AUSTRALIA.—Northern Province: between Ashburton and De Grey Rivers, *Clement;* Nickol Bay, in 1878, *Forrest;* De Grey Stn., Jul 1941, *Burbidge* 1556; Mulyie Stn., De Grey R., in 1898, *Anderson* and Mar 1899, *A. Morrison;* Warralong Stn., Coongan R., with *Triodia pungens,* May 1941, *Burbidge* 864; Mt Edgar Stn., SE of Marble Bar in small stony creek; Jun 1941, *Burbidge* 1088; between De Grey R. and Lagrange Bay, in 1879, *Forrest & Carey*; Lagrange Bay, in 1885, *Panton.* Eremean Province: Austin District:

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70 miles S of Onslow on Northwest Coast Highway, Aug 1965, *Beauglehole* 11619; 52 miles N of Carnarvon, Aug 1969, *Ashby* 2945; Quobba Stn., Sep 1963, *Berston* 1; Carnarvon, Sep 1910, *hb. Morrison;* Upper Gascoyne R., in 1890, *C. D. Brown;* near Mt Hale, in 1877, *Carr* and in 1884, *Crossland;* Yuin, in 1888, *Hymus;* between Alfred and Marie Range and Rawlinson Ranges, *Giles;* 77 miles SW of Warburton Mission, Aug 1961, *George* 2906. Coolgardie District: Lake Brown, in 1889, *Merrall*; Bruce Rock, *Stoward* 135; Coolgardie, in 1900, *Webster;* Victoria Rocks SW of Coolgardie, Sep 1962, *George* 4216; Fraser Range, in 1876, *Dempster.* South-West Province: Without further locality *Drummond* 985. Irwin District: Battie Pool, Murchison R., *Oldfield,* and Aug 1927, *Gardner;* Northampton, Nov 1905, *Campbell,* Oct 1909, *Maiden,* and Sep 1929, *Gardner;* near Northampton, Mar 1909, *Thompson in hb. Morrison;* Champion Bay, *Wallcott;* Greenough R., Nov 1877, *?;* Darling District: Swan View, Mar 1904, *Fitzgerald,* and Jan 1925, *Gardner;* Darling Range, Jan 1922, *Steedman;* Darlington, Darling Range, Ded 1889, *Morrison.* Avon District: York, *Fairburn;* beyond York, *Fairburn;* Muresk, Sep 1945, *E. T. Bailey* 608; Killerberrin, Sep 1897, *Leakey in hb. Morrison.*

NORTHERN TERRITORY.—Darwin and Gulf District: Black Rocks, Macarthur R., Oct 1911, *Hill* 652. Alice Springs District: 1 mile W of Tanami, *Triodia* grassland on laterite soil, *Eucalyptus brevifolia, Acacia minutifolia,* Apr 1971, *Dunlop* 2129; Barrow Creek, in 1880, *Chandler* 73; S of Assanga Stn., in 1932-3, *Strehlow;* 50 miles N of Macdonnell Ranges, May 1922, *S. A. White* 117; 13 miles NW of Yeundumu, in mulga woodland, Jul 1954, *Winkworth* 392; on Hamilton Downs Stn., Sep 1955, *Chippendale* NT.1738; Macdonnell Ranges, *Stuart;* Hermannsburg, in 1879, *Kempe;* 2 miles NE of Hermannsburg Mission, occasional on red soil with *Acacia aneura* woodland, May 1955, *Lazarides* 5313; Kings Canyon, near waterhole in upper level of canyon, in sandy soil under shade of gum trees, not common, Dec 1968, *Latz* 299; 9 miles N of Alice Springs, Aug 1932, *Cleland;* Alice Springs, May 1875, *Giles;* 1 mile E of Alice Springs, Mar 1953, *Perry* 3215; Mt Olga, Jun 1926, *Basedow* 100 of Mackay Exploring Expedition; Mt Olga, on bare rocky dome, Jun 1953, *Symon;* between Ayer's Rock and Mt Olga, Jun 1953, *Symon;* between Alberga R. and Mt Olga, in 1873-4, *Giles.*

SOUTH AUSTRALIA.—Far North West: West of Everard Range [at Mt Goolwa], on sandy soil on lime deposit, Jun 1891, *Helms;* Ernabella, Sep 1945, *Cleland.* North West: Granite Downs Stn., W of Oodnadatta, Aug 1953, *Reid.* Flinders Range: Mt Lyndhurst, Nov 1898, *Koch* 53?; Lower slopes of Mt John, Wilpena, Sep 1961, *Symon* 1341; between Lyndoch Valley and Gawler, in scrubs on barron hills, Feb 1851, *Mueller.* Mt Lofty Range: Torrens Gorge near Adelaide, Dec 1903, *Black;* Black Hill near Adelaide, Jul 1927, *Cleland;* foot of Black Hill, May 1969, *Spooner* 416; Windy Point Road, above Mitcham, Adelaide, Feb 1940, *C. A. N. Smith.* River Murray: Murthoo, Jan 1884, hb. *Tate.*

QUEENSLAND.—Burke District: Norman R., in 1884, *Dugan;* near Mt Isa, common on lower skeletal slopes, Mar 1954, *Lazarides* 4370. Gregory North District: Ardmore Stn., ± 25 miles W of Dajarra, in red sandy soil with numerous quartzite pebbles, Nov 1947, *Everist* 3266; Woodstock Stn., W of Winton, chiefly near channels in gidgee (*Acacia cambagei*) country, Jun 1934, *Blake* 6517; Elderslie Stn., W of Winton, in silty wash on ironstone country, Aug 1934, *J. F. Kennedy* 5. Gregory South District: Waverney Stn., ± 40 miles W of Windorah, in loose brown sandy silt, on edge of gully, Sep 1949, *Everist* 4112; Nockatunga Stn., Jan 1935, *Boyle.* Mitchell District: 20–40 miles SW of Winton on Opalton Road, black soil with red rocky ridges, Dec 1969, *Shield* 5; 16 miles NW of Longreach, red sandy soil, Jul 1952, *D. Davidson* 251; Corona Stn., 50 miles W of Longreach, in hard red clay, not common, Feb 1936, *Everist* 1502; Vergemont Creek crossing on Vergemont road, ca. 75 miles WSW of Longreach, downs country verging on to red soil country, Mar 1970, *Law;* Barcaldine, Dec 1919, *White;* Jericho, Jan 1908, *Simmons,* and on rather flat country on fine grey sand in *Eucalyptus melanopholia-E. populifolia* forest, 360 m, Nov 1935, *Blake* 10264. Warrego District: Yappunyah Stn.

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near Thargomindah, Apr 1885, *Spencer;* "Mirintu", Hungerford, Aug 1960, *Stranger;* 7 miles N of Hungerford, on Paroo Channels, occasional on red sand islands out of river flow, Apr 1962, *Ebersohn* E203; Caiwarro Stn., (NE of) Hungerford, in 1885, *Cotter* 16; Cowley Stn., 40 miles E of Quilpie on main Quilpie-Charleville road, mulga country, Jun 1959, *Anson* 16; Eulo, along small gullies from a mulga ridge, Sep 1933, *Tambling* 21; Charleville, in railway enclosure on sandy soil, ca 300 m, Apr 1934, *Blake* 5399; SW of Charleville, common in sandy soil alongside railway line, Dec 1935, *Everist* 1418; S of Charleville, Jun-Aug 1960, *Cole* 50A; between Charleville and Westgate, on red sand associated with *Eucalyptus melanophloia* and *Triodia*, Apr 1934, *Blake* 5416; near Cunnamulla in very sandy soil, Apr 1941, *White* 11585; Deiran Stn., E of Cunnamulla, brown soil of light texture with mulga and box, Mar 1953, *S.W.Q.S.* 1338. Maranoa District: Armadilla, *Burton* 70; Boatman Stn., in red fine sand, Mar 1947, *Everist* 2834; 40 miles NW of Roma around "Gwenbrook" house on red sand, Apr 1971, *Thomas;* between Bollon and Cunnamulla in forest country, Jan 1935, *Winders;* St. George, May 1894, *Wedd* 589; Noondoo near Dirranbandi, on stony ground in *Eucalyptus melanophloia-Callitris* forest, May 1936, *Blake* 10742. Burnett District: near (SE of) Eidsvold, *Eucalyptus-Angophora* forest, on shallow sandy soil overlying sandstone, May 1956, *Blake* 20004; Mundubbera, in 1930, *Bloxsome* 92; top of Dividing Range E of Wandoan, near Cadarga, in 1930, *Belson.* Darling Downs District: between Miles and Drillham, in grey fine sand in *Eucalyptus-Acacia* forest, 330 m, Feb 1935, *Blake* 7712; Miles, in 1930, *Belson;* 11 miles E of Condamine, Oct 1940, *Smith & Everist* 827; Chinchilla, *Beasley* 118; Wyaga Stn., [NE of] Goondiwindi, Sep 1919, *White;* between Inglewood and Milmerran, in very sandy soil, Jan 1934, *White* 9778B; Yandilla, *Law;* Messines, near [about NW of] Stanthorpe, Dec 1930, *Greener;* Stanthorpe, Dec 1875, *Bailey*; Wyberba, on rocky hillsides, Jan 1933, *Blake* 4557; near Bald Rock Creek near Wyberba, among rocks in exposed places, 750–900 m, Jan 1933, *Blake* 4614.

NEW SOUTH WALES.—Far Western Plains: Tibooburra, among granite boulders, 187 m, Oct 1949, *Constable* NSW 11157; Waverley Downs, red soil, very rare, Apr 1906, *Muller* 42; W of Paroo R., red soil, in 1903, *Muller* 33; Grey Range, on Queensland boundary, *Bauerlen* 349; Broken Hill, in very rocky situation, Oct 1919, *Morris* 48; Darling R., *Dallachy & Goodwin.* Western Plains: Bokhara, Jan 1847, *Leichhardt;* Angledool, *Newcomen in hb. Woolls;* Brewarrina, Nov 1903, *Boorman;* Bourke district, May 1900, *?;* Clover Creek near Bourke, in 1891, *Mackay*; Bourke to Byrock, in dry grassland, Dec 1934, *Vickery* 58; Bourke to Cobar, Apr 1939, *McKie;* Walgett, *Musson* 360; Gongolgon, Feb 1910, *Hall;* Louth, Sep 1910, *Abraham* 24; Narrabri, Nov 1899, *Maiden;* Coolabah, Aug 1891, *hb. Jared G. Smith* 7; Coolabah district, Feb 1941, *Butchee* 3; Cobar district, Jun 1939, *comm. Glenfield Vet. Res. Stn;* Mt Harris Stn., 40 miles NNW of Warren, Apr 1952, *Constable* NSW 20360; Murrumbidgee R., *Campbell.* North West Slopes: Warialda, Jun 1905, *McDonald,* Mar 1906, *Rupp* 18, Jun 1914, *Boorman,* and Mar 1935, *R. R. Vickery;* Liverpool Plains, Feb 1880, *?.* Northern Tablelands: Chandler's Peak, Guyra, Mar 1917, *Boorman;* New England, *Stuart.* Central Western Slopes: Dubbo, Jun 1914, *Boorman;* near Wellington Valley, *Cunningham;* Mudgee, in 1870, *Taylor;* near Mudgee, *?;* 8 miles W of Singleton, locally fairly frequent in open woodland of *Angophora, Banksia* and little eucalypt on deep dry sand, May 1960, *Story* 7392; Cowra, on granite sandstone, Jan 1915, *Breakwell.*

VICTORIA.—Mallee: Without further locality, *Shepherd;* Murray R., Dec 1887, *hb. Walter;* Murray R., Dec 1858, *Mueller.*

C. obtectus is a plant of the drier regions that apparently does not reach the east coast. According to the label *Dietrich* 516 (not cited above) was collected at Port Mackay (= Mackay), a most unlikely locality; Dietrich made many collections around Lake Elphinstone, inland from Mackay, but even this is far distant from any other locality known for the species.

As stated in the protologue, the species identified with *C. bombycinus* by earlier authors and also more recently by J. M. Black, Fl. S. Aust. ed. 2 (1943) and C. A. Gardner, Fl. W. Aust. 1:340 (1952); the more important distinguishing characters are given in the key to the species and the very different distribution shown in Figs. 7 and 8.

In hb. Munich there is a specimen collected by Angelrodt in Aug 1876 from a plant cultivated in Nordhausen, Germany.

Burbidge 1088 has unusually broad inflorescences, one on a complete culm of 65 cm being 38 cm long and 9 cm wide, the other from a probably taller culm without the lower part being 62 cm long and 13 cm wide but the racemes form a dense mass only 12 cm long.

6. Cymbopogon queenslandicus S. T. Blake; species nova, affinis *C. recto* (Steud.) A. Camus a quo spiculis sessilibus minoribus haud acuminatis gluma inferiore marginatis vel alatis dorso sulcatis, spatheolis minoribus pedunculis pro ratione longioribus praecipue differt. Typus: Queenslandia, Townsville, *Blake* 8353 (BRI.045247, 045246, holo; K; isotypi alii distribuendi).

Gramen perenne dense caespitosum aromaticum basi dense foliatum innovationibus intravaginalibus. Culmi erecti vel subnutantes 70–150 cm longi, sub inflorescentia 1–3-nodes, vel scabridi vel ± scabriduli vel laeves, interdum etiam praecipue ad vel etiam prope nodes ± pubescentes. Foliorum vaginae crebre nervosae ± scabro-pubescentes vel tandem fere laeves, probe os collumque ± pubescentes, eae foliorum caulinorum arctae, persistentes, internodiis breviores, eae basalium emarcidorum divergentes, rectae, ± involutae; ligulae 1·8–5 mm longae; laminae lineares in apicem filiformen longe attenuatae basin versus sensim angustatae in vaginam abrupte dilatatae, sicco firmae ± flexuosae, tandem planae, nervorum primariorum 3–5 paribus atque nervis secundariis tertiisque percursae, utrinque scabrae, plerumque 15–50 cm longae et 2·7–10 mm latae. Panicula ⅓–⅔ culmi occupans, angusta, nec sparsa nec densa, fere continua, circiter 6–9-nodis, ad gradum secundum vel tertium ramosa plerumque 25–45 cm longa et 4–8 cm lata; internodia subtus nodos glabros pubescentia hic etiam ± barbata vel ± ciliolata; rami internodiis longiores, ± scabri parte superiore praecipue subtus nodos pubescentes hic etiam barbati. Spatheolae angustissime ellipticae, utrinque acutae, dorso multinervae scaberulaeque, marginibus late hyalinae, 18–25 mm longae. Pedunculi filiformes, glabri laevesque, 8–12 mm longi, ⅓–½ spatheolae adaequantes. Racemi mox divergentes tandem reflexi, ± 17–20 mm longi, 4–6-articulati, primo spatheolam conspicue superantes dein e medio vel paulo infra medium hujus emergentes; spicularum par imum racemi subsessili homogamum ejus pedicellus liber haud inflatus. Articuli pedicellique lineares applanati vel ventro concavi, dorso convexuli, sub apice aliquantum cyathiformi alte inaequeque bifido leviter dilatati, marginibus pilis sursum sensim longioribus usque ad 3 mm longis omnino dense ciliati; articuli 2–2·4 mm longi interdum dorso villosi; pedicelli hos aequantes vel fere aequantes dorso glabri. Spiculae sessiles angustissime oblongo-ellipticae vel -obovatae, ± obtusae, plerumque pallidae, 4·5–5·7 mm longae, 1–1·2 mm latae. Gluma inferior a medio vel paulo sub medio 2-carinata carinis marginata vel alata alis usque ad 0·35 mm latis sursum haud attenuatis, nervis intracarinalibus 2–4 tenuibus interdum basin versus evanescentibus praedita, si 4 nunc 2 intimis secus medium approximatis, dorso supra medium planiuscula opaca infra laevis nitida secus medium longitudinaliter sulcata, nonnunquam inter carinas quoque concava. Gluma superior carina supra medium alata, marginibus ciliolata ceterum glabra. Lemma inferius oblongum obtusum. Lemma superius usque ad medium bilobum; arista perfecta 10·5–12 mm longa. Antherae circiter 2–2·5 mm longae. Spiculae pedicellatae ♂ angustissime ovatae acutae, 4·5–6 mm longae; gluma inferior nervis intracarinalibus 7–9 praedita, carinis sursum scabra alibi glabra laevisque.

Culms erect or inclined towards the top about 0·7–1·5 m long, 1–3-noded below the inflorescence, the internodes densely to minutely and sparsely scabrid or smooth, sometimes also ± pubescent, chiefly at and sometimes also just below the nodes. Leaf-sheaths shorter than the internodes, closely nerved, ± scabrous-pubescent or sparsely or minutely so or at length almost smooth, ± pubescent about orifice and collar, those of the basal leaves at length diverging, straight and ± inrolled; ligules 1·8–5 mm long; collar glabrous or puberulous; blades gradually narrowed to the base and abruptly widened to the sheath, firm and ± flexous in the dry state, at length flat, about 15–50 cm long and 2·7–10 mm wide, shortly and finely scabrous, densely so beneath, with 3–5 pairs of primary nerves and with secondary and tertiary nerves. Panicle occupying $\frac{1}{3}$–$\frac{2}{3}$ the culm, narrow, neither sparse nor dense and nearly continuous, about 6–9-noded branched to the second or third degree, about 25–45 cm long about 4–8 cm wide, internodes of axis ± pubescent beneath the glabrous nodes or also ± bearded or ± ciliate branches longer than the internodes, pubescent in upper part at least below the nodes and there also ± bearded, ± angular also ± scabrous. Spatheoles very narrowly elliptic, scaberulous on the back, 18–25 mm long. Peduncles filiform, glabrous, smooth, 8–12 mm long, $\frac{1}{3}$–$\frac{1}{2}$ as long as the spatheole. Racemes soon divergent at length reflexed, about 17–20 mm long with about 8–11 awned spikelets per pair exserted from or a little below the middle of the spatheole and conspicuously overtopping the latter before diverging, each 4–6 jointed. Joints and pedicels linear, flattened or concave ventrally, silghtly convex on the back, slightly dilated below the somewhat cup-shaped, deeply and unequally bifid tip; densely ciliate all along the margins with hairs increasing upwards up to 3 mm long, the longer ones about as long as the joints, slightly dilated below the somewhat cup-shaped, deeply and unequally bifid tip; joints 2·2–3 mm long; sometimes villous on the back; pedicels, if anything, a little shorter, glabrous on the back. Sessile spikelet very narrowly oblong-elliptic or –obovate ± obtuse, usually pallid, 4·5–5·7 mm long, 1–1·2 mm wide. Lower glume 2-keeled from the midddle or a little below, the keels marginate to winged with wings up to 0·35 mm wide not attenuate upwards, with 2, 3, or 4 intracarinal nerves, when 4 sometimes the two inner ones approximated along the middle, all slender and sometimes disappearing towards base, the back flattish and dull in the upper half, smooth and shining downwards with a longitudinal U-shaped groove along the middle, sometimes concave between the keels with the groove in the concavity (2 nerves least common, when 3, one central). Upper glume winged on the keel in the upper half, ciliolate on the margin otherwise glabrous. Lower lemma oblong, obtuse. Upper lemma bilobed to the middle; awn 10·5–12 mm long. Anthers about 2–2·5 mm long. Pedicelled spikelets ♂ very narrowly ovate acute, 4·5–6 mm long. Lower glume with 7–9 intracarinal nerves, glabrous and smooth except for the keels scabrous in upper part; upper glume nearly as long, ciliate lower lemma shorter. Fig. 7.

Queensland.—Cook District: Jervis I., Torres Strait, in 1878, *J. Chalmers;* Albany I., Aug 1855, *F. Mueller;* Bailey Ck, N of Daintree R., *Cowley* (?); Hann Tableland, 16° 55′ S, 145° 15′ E, open forest, granite soil, Mar 1970, *Nicholson;* Stannary Hills, in 1909, *T. L. Bancroft;* near Davies Ck, between Kuranda and Mareeba, *Eucalyptus* forest, reddish stony soil, ± 420 m, Feb 1950, *Blake* 20296; Kuranda, Feb 1922, *White* 1556; Cairns, on steep grassy hillsides on grey slightly sandy loam, Mar 1938, *Blake* 13353; Rocky I. near Yarrabah, Jan 1910, *Domin;* Cape Grafton, Jan 1910, *Domin.* North Kennedy District: Dunk I. ?, 257; Castle Hill, Townsville, Feb 1910, *Domin;* Townsville, upper slopes of Castle Hill, 210–300 m, Mar 1935, *Blake* 8353. South Kennedy District: 7 miles NE of "Wollombi", common in red earth on basalt scarp with *Eucalyptus drepanophylla* woodland, Nov 1964, *Adams* 1096. Leichhardt District: Bruce Highway, 65 miles SSE of Nebo, dominant on rocky slopes with *Eucalyptus crebra,* Jul 1962, *Story & Yapp* 160; "Lexington", N of Springsure, on rocky basalt slopes ca. 300 m, Jul 1934, *Blake* 7008. Port Curtis District: Herbert Ck, in 1870, *Bowman;* Blackdown Tableland, ca. 32 km SE of Blackwater, brown sandy soil over and between sandstone in open *Eucalyptus* forest, Apr 1971, *Henderson, Andrews & Sharpe* 778; Gracemere, Feb 1876, *O'Shanesy* 1668, 1669; Rockhampton, *O'Shanesy;* near Rockhampton on mid slopes of Mt Berserker, in *Eucalyptus* forest on dark grey sandy loam, Mar 1937, *Blake* 12720; Mt Wheeler, *Thozet;* Marmor, between Rockhampton and Gladstone, on cleared monsoon-forest country, Mar 1937, *Blake* 12779. Burnett District: "Brian Pastures" near Gayndah, Jan 1959, *Schoneveld* 60.

Specimens of this species were referred either directly or by implication to *Andropogon martinii* Roxb. by F. Muell. Fragm. 8:124 (1873), *Andropogon schoenanthus* L. var. *martinii* (Roxb.) Benth. by Bentham, Fl. Aust. 7:534 (1878), to *A. nardus* L. subsp. *grandis* (Nees in Steud.) Hack. by Hackel in DC. Monogr. 8:605 (1889), to *A. nardus* L. var. *grandis* (Nees in Steud.) F. M. Bail. by F. M. Bailey, Qd. Fl. 6:1865 (1902) and *A. nardus* L. var. *australiensis* Domin by Domin, Biblioth. Bot. 20, heft 85:264 (1915). The last mentioned name was proposed expressly for the Australian taxon without description but with citation of the other names mentioned above. *A. martinii* (*A. schoenanthus* var. *martinii*) was founded on Indian material, *A. grandis* (*A. nardus* subsp. *grandis, A. nardus* var. *grandis*) on a collection from Java and treated by me as a taxonomic synonym of *Cymbopogon flexosus* (Nees) Wats. in Atkins. (Proc. Roy. Soc. Qd. 80:73 (1969), *A. nardus* on material from Ceylon and *A. schoenanthus* on material from Arabia though the last name has been wrongly applied to other species including *A. martinii A. nardus* and *A. citratus* DC. (see Stapf, Kew Bull. 1906:303–313 (1906), Bor, Notes Roy. Bot. Garden Edinburgh 25:61 (1963)). In all cases cited above the authors included the scanty Australian material available to them in their concept of the taxa mentioned. *A. nardus* var. *australiensis* is at best a superfluous name for *A. schoenanthus* var. *martinii,* the earliest name of similar rank cited in the synonymy, but the Australian taxon is quite distinct from *A. martinii* which has a ± cordate or amplexicaul base to the leaf-blades, shorter peduncles, the pedicel of the homogamous pair grossly swollen, the lower glume of the hermaphrodite spikelet without intracarinal nerves but with a deep narrow slit rather than a furrow in the lower part, shorter cilia and is altogether a coarser plant.

C. queenslandicus resembles *C. rectus* (Steud.) A. Camus from Java and Lombok which has larger acuminate sessile spikelets 6·5–7 mm long and 0·9–1·1 mm wide, widest at or shortly below or above the middle, less narrowed below with the lower glume flat on the back or concave towards the base between the keels, sometimes with a depression or wrinkle above, marginate to narrowly winged but without affecting the acuminate shape of the spikelet, with 2–3 intracarinal nerves prominent sometimes right to base; also the spatheoles are longer and wider, the peduncles shorter, and the racemes before expansion about as long as (not conspicuously longer than) the spatheole and exserted well towards the base rather than the middle. *C. nardus* (L.) Stapf is a much stouter plant with a dense panicle, usually smaller sometimes smooth spatheoles overtopping the smaller racemes (12–15 mm), somewhat shorter joints and pedicels with much shorter hairs (hairs rarely exceeding 1·5 mm long) ± acuminate spikelets concave between the keel-nerves in the lower part often without intracarinal nerves, and much shorter or no awn. *C. goeringii* (Steud.) A. Camus from China and Japan has prominently winged sessile spikelets but these are somewhat wider, slightly convex to flat or nearly so nearly throughout on the back, mostly larger and more acute, the hairs on the joints and pedicels are much shorter, the peduncle is at least half and often more than half the length of the spatheole, and the leaves are less narrowed to the base.

C. flexuosus (Nees) Watson from India but cultivated and perhaps naturalized elsewhere has curled basal sheaths and smaller relatively broader sessile spikelets only 3–4 mm long but about 1 mm wide, with the lower glume flat or shallowly concave on the back towards the base, the keels incurved in the upper part with a narrow wing about straight on its outer edge, and sometimes quite obscure intracarinal nerves.

C. tortilis (Presl) A. Camus from Malesia and southern China has smaller spatheoles, racemes, peduncles and spikelets; the sessile spikelets are only 3·5–4·5 mm long, acute or acuminate with the lower glume merely marginate and not grooved on the back.

C. globosus Henr. (p. 33) has culms mostly 4–6-noded below a short dense inflorescence with racemes overtopped by their spatheoles before expansion and with their basal homogamous pair of spikelets very much reduced and more or less caducous.

C. queenslandicus appears to be confined to Queensland where it is found with other grasses on more or less stony hillsides in *Eucalyptus* forest. An apparent hybrid with *C. refractus* is discussed on p. 61.

7. Cymbopogon refractus (R. Br.) A. Camus, Rev. Bot. Appliq. 1:279 (1921). Based on *Andropogon refractus* R. Br.

Andropogon refractus R. Br. Prodr. 202 (1810). Type: Port Jackson *R. Brown* [6177] (BM, holo; E, K, P).

Andropogon tahitensis Hook. & Arn. Bot. Beechey's Voy. 72 (1832). Type: Society Is., *Beechey* (K).

Sorgum refractum (R. Br.) O. Kuntze, Rev. Gen. Pl. 2:792 (1891). Based on *Andropogon refractus.*

Andropogon refractus R. Br. var. *luxurians* Domin, Biblioth. Bot. 85:265 (1915). Type: Near Brisbane, Apr 1910, *Domin* (PR, holo; BRI).

Andropogon refractus R. Br. var. *luxurians* Domin f. *euryphyllus* Domin, loc. cit. Type: Stradbroke I., Apr 1910, *Domin* (PR, holo; BRI).

Andropogon refractus R. Br. var. *tropicus* Domin, loc. cit. Type: Near Harvey Creek, Dec 1909, *Domin* (PR, holo; BRI).

Cymbopogon nardus L. subvar. *refractus* (R. Br.) Roberty, Boissiera 9:176 (1960), nomen invalidum. Based on *Andropogon refractus.*

Culms erect or oblique or inclined or overarching upwards, about 30–150 cm long, simple and (1–)2–3-noded beneath the inflorescence, the internodes smooth and glabrous. Leaf-sheaths, those on the culm smooth glabrous, the basal ones scaberulous towards the base also ± silky pubescent towards the base, the old ones persistent, flattened and straight or nearly so, at length disintegrating into pale-coloured fibres, glabrous at the mouth; collar glabrous; ligules 0·4–2·2 mm long, minutely ciliolate, no row of hairs behind; blades folded to flat, attenuate to base, scaberulous beneath, smooth on top with 1–4 pairs of veins, less than half as long as the culm, mostly 12–40 cm long mostly 1–4 mm wide rarely 0·5 or up to 6 mm. Panicle occupying ¼ to nearly ½ the culm, linear, mostly 10–45 cm long, mostly 2–4 cm wide, ± interrupted, (3–)4–9-noded, branched to the first or second degree; internodes of axis glabrous and smooth or slightly scabrous-ciliate immediately below the node; branches mostly 1–2-nate, up to 4-nate, usually appressed, the uppermost longer, the lower ones often shorter to much shorter than the internodes. Spatheoles narrowly elliptic ovate, 17–23 mm long, smooth and glabrous. Peduncles stiff, terete, glabrous, 7–13 mm long, about ⅓–⅗ as long as the spatheole. Racemes as long as to much exceeding the spatheole before exsertion; soon widely spreading then deflexed, usually glabrous in appearance, often pruinose, about 13–20(–23) mm long, each with 3–5 hermaphrodite spikelets; bases pubescent; joints and pedicels linear or linear-cuneate, 0·6–1 mm wide, concave on the inner side, convex on the back and often ± angular in the upper part, entirely glabrous or the margins ± ciliate, the hairs usually few, not exceeding 1·5 mm long and usually much less, a few sometimes on the dorsal angle; joints frequently with ± parallel sides below and dilated only beneath the irregularly lobed or ± denticulate obliquely cup-shaped tip, 3–3·7 mm long, $\frac{1}{2}$–$\frac{2}{3}$ as long as the sessile spikelets; pedicels slightly to distinctly shorter (by up to 0·8 mm), more swollen upwards, the spikelet usually not disarticulating. Sessile spikelets very narrowly ovate-elliptic or in the lower part narrowly oblong, gradually very acute or also acuminate from the middle or a little below the middle, the sides below being parallel almost to the base or gradually narrowing to the base, pallid, 5·3–6·5 mm long, 0·8–1·3 mm wide, 4·5–7 times as long as wide; callus glabrous or bearded with hairs up to 1 mm long. Lower glume 2-keeled, inflexed from about the middle, the keels smooth in the upper part not at all marginate, intracarinal nerves 3–5 sometimes faint or obscure especially below the middle or there absent; back flat or slightly convex in the upper part, flat or with 1 or 2 faint to conspicuous longitudinal furrows in the lower part. Upper glume 3-nerved, smooth on the unwinged keel. Lower lemma nearly as long as the glumes, narrowly suboblong. Upper lemma narrowly oblong, about half as long as the glumes, entire, emarginate or bilobed to as much as $\frac{1}{3}$ the length, commonly muticous, sometimes cuspidate, rarely awned, the awn sometimes perfect up to 12 mm long. Palea sometimes present, up to 1 mm long. Grain narrowly oblong elliptic in outline, more narrowed upwards than below, turgid on embryo side, ± flattened on the other and somewhat concave along the middle line, 2·25–3·5 mm long, 0·6–1 mm wide; embryo half as long. Pedicelled spikelets usually persistent, neuter, very narrowly ovate, acute with rigid ± squarrose tip, about 4·5–5·5 mm long, commonly reduced to the lower glumes with 7 intracarinal nerves and a smaller to rudimentary upper glume. Fig. 9.

NORTHERN TERRITORY.—Darwin and Gulf District: Port Essington, *Armstrong;* Yirrkala, 12° 12′ S, 136° 47′ E, edge of monsoon forest on coastal dune, Sep 1948, *Specht* 1019; Humpty Doo, in red soil in dense shrub vegetation, Apr 1967, *C. S. Robinson* CSR25; Douglas River Crossing, Mar 1972, *Passlow* N.T. 244; Groote Eylandt—Little Lagoon, in *Eucalyptus tetrodonta* open forest on sandy soil, Apr 1948, *Specht* 208; 36 miles E of Borroloola, sandy alluvium, Jul 1948, *Perry* 1809.

QUEENSLAND.—Cook District: Lockerbie Stn., 10 miles WSW of Somerset, scattered examples in an old clearing in rain forest, 30 m, Apr 1948, *Brass* 18393; Skull Ck., Bamaga, Jun 1971, *Nicholson* 4761; Galloway Ck near Bamaga near Cape York, littoral vine woodland on sand plain, May 1962, *Webb & Tracey* 6069; Coen, in forest, along river banks, Apr 1922, *?*, and in mixed Eucalyptus woodland, May 1967, *Symon* 4815; Musgrave, *Barclay Millar;* Palfrey I., near Lizard I., Jul 1969, *Heatwole;* Point Saunders, mouth of Endeavour R., north shore opposite Cooktown, in dune scrub, May 1970, *Blake, Correll & Stearn* 23501; Staaten R., in sandy ground near creeks, in 1883, *Palmer* 123; Smelling Bluff, near Chillagoe, Nov 1909, *Domin;* Parada, roadside, 400 m, Apr 1962, *McKee* 9362. Burke District: near source of Poison Creek, about 90 miles N of Hughenden, in *Eucalyptus-Callitris* forest on compact sand, 780 m, Apr 1935, *Blake* 8489A. North Kennedy District: Kaban, Oct 1917, *Harte;* Ravenshoe, rather damp hillside in *Eucalyptus* forest on light brown loam, Jun 1935, *Blake* 9570; 43 miles SSW of Mt Garnet, occasional in scrubby community on red basaltic soil, Feb 1954, *Lazarides* 4209; mouth of Hull R., Aug 1938, *Langdon;* north of Pentland, near Cape R., hillside in *Eucalyptus* forest on sand, ± 375 m, Apr 1935, *Blake* 8411. South Kennedy District: 3 miles NE of Cerito Stn., frequent in narrow-leaved ironbark woodland, May 1964, *Adams* 965; Mackay, Jan 1938, *Bourke.* Mitchell District: near Barcaldine, Mar 1910, *Domin;* Jericho, Jan 1908, *Simmons.* Leichhardt District: 2 miles W of Broadmeadow homestead, with *Bothriochloa, Eragrostis* and

Aristida spp., Jun 1962, *Story & Yapp* 118; Springsure, softwood scrub, Mar 1958, *Skerman;* Carnarvon Range, near creek bed, Feb 1960, *Butler;* 20 miles NW of Theodore, open poplar-box forest, red-brown sandy clay loam, Apr 1963, *Johnson* 2609. Port Curtis District: Middle Percy I., common on stony skeletal slopes and sandy soil, Feb 1960, *Lazarides* 5637; South Percy I., Mar 1906, *Tryon;* near (S of) Stanage Bay (NW end of Shoalwater Bay), near coast, hillside in *Eucalyptus* forest, stony to sandy soil, Apr 1945, *Blake & Webb* 15648; Herbert Ck, *Bowman;* Blackdown Tableland, ca 32 km SE of Blackwater, 600–900 m, alongside road in rather dense *Eucalyptus-Casuarina* forest, brown sandy loam, Apr 1971, *Henderson, Andrews & Sharpe* 688, and sandy soil over sandstone in open *Eucalyptus* forest, Apr 1971, *Henderson, Andrews & Sharpe* 701; Gracemere, not common, Feb 1868, *O'Shanesy* 3 (ser. 9); Rockhampton, *O'Shansey;* near Rockhampton on mid slopes of Mt Berserker, in *Eucalyptus* forest on dark grey sandy loam, Mar 1937, *Blake* 12718; Curtis I., Southend, Dec 1959, *Mackenzie;* Biloela, in 1930, *Cowdry* 28; Baffle Creek district, Apr 1920, *White.* Burnett District: Mundubbera, in 1930, *Bloxsome* 62; Dallarnil, not particularly common, Dec 1939, *L. S. Smith* 653; Wondai, Feb 1931, *White* 7221; Murgon Tableland, May 1951, *Symon* 7334; Nanango, Dec 1930, *Watson,* and in native pasture, in sandy loam on granite, Mar 1965, *R. W. Williams* B78. Wide Bay District: without further locality, *Bidwill;* Booyal, Apr 1931, *Coleman* 10; Howard, received May 1931, *N. E. Watson* 8; Maryborough, Mar 1909, *Maiden;* Fraser I., eastern side, inland from Happy Valley, in sclerophyll forest, sandy soil, May 1967, *Baxter* 918, 931. Warrego District: Chesterton Stn., approx. 25° 20′ S, 147° 20′ E, in *Callitris-Eucalyptus* forest on very sandy soil, 570 m, Apr 1936, *Blake* 11136. Maranoa District: Amby Downs, Dec 1883, *Scortechini;* Roma, in brigalow (*Acacia harpophylla*) scrub ca 300 m, Mar 1936, *Blake* 10841; Parkhurst Stn., St George in 1955, *M. Taylor.* Darling Downs District: Wallumbilla, Apr 1931, *Blunden* 19; near Gurulmundi, in 1930, *Belson;* Dogwood Ck, E of Gurulmundi, in 1930, *Belson;* Condamine, Jun 1962, *Turnbull* 1; Canaga, light forest country, Apr 1958, *Sperling;* Chinchilla, partly cleared scrub land, Apr 1921, *Beasley* 2, and Dec 1930, *Beasley* 8; Jandowae, Mar 1920, *Moore* 16; Dalby, Apr 1931, *Beiers* 65; Kindon Stn., 54 miles NNE of Goondiwindi, Dec 1938, *L. S. Smith* 565; Goondiwindi, Mar 1941, *Douglas;* Warroo Stn., (SE of) Inglewood, hard ground on hill, Dec 1955, *Goodrich* 3; between Inglewood and Milmerran, Jan 1934, *White* 9751; Inglewood, Mar 1911, *Boorman;* Oakey, in 1930, *Donges* 26; Greymare, open forest, grey-brown stony clay loam, Dec 1961, *Kirkpatrick;* Condamine (R), in 1875, *Hartman* 532; Warwick, *Beckler;* Stanthorpe, *Bailey;* Wallangarra, parkland, Jan 1933, *Blake* 4424, and on hilltop, Dec 1944, *Hilton.* Moreton District: Somerset Dam, May 1951, *Symon* 7335; Helidon, podsolized soil, May 1951, *Symon* 7336; Gatton, Feb 1930, *White* 6607; Little Liverpool Range near Mt Castle, Mar 1938, *Roe;* Mt Edwards, common in a variety of situations, Apr 1934, *Everist* 603; ca 1 mile NW of Beerwah, reddish sandy loam on roadside, May 1970, *Tutt;* N of Petrie on a railway embankment, Dec 1930, *Blake* 99; Petrie, in open *Eucalyptus* forest, on well-drained fairly poor soil, Dec 1930, *Blake* 88; Cash's Crossing, near Brisbane, Jan 1938, *L. S. Smith* 262; Brisbane R., *Dietrich* 2729 (601), and *Eaves;* Brisbane, Mar 1873, *Bailey* 34; Brisbane (Geebung), in *Eucalyptus* and *Melaleuca* forests, Mar 1940, *Blake* 14157; (Ferny Grove), in *Eucalyptus* forest on hillsides with stony soil, 60–120 m, Mar 1941, *Blake* 14310; (Enoggera), Jun 1919, *White;* (Mt. Coot-tha), on stony soil among blady grass, Mar 1963, *Gillieatt* 23; (near Mt. Coot-tha), along creek bank, not common, Mar 1931, *Everist* 31; and common on drier slopes, Jan 1932, *Everist* 291; (Kenmore), Dec 1959, *Kleinschmidt* 22; (Moggill), Dec 1858, *Stuart* 269; (Morningside), river lowlands, sandy soil, Jun 1963, *Henderson* H.32; (Whites Hill), very common in *Eucalyptus* forest, Apr 1930, *White* 6686; (Mt Gravatt), common, Feb 1938, *L. S. Smith* 306; near Brisbane, Apr 1910, *Domin;* Mt Cotton, very common in *Eucalyptus* forest, Feb 1935, *Everist* 972; Beenleigh, Jan 1932, *Michael* 1913; Tamborine Mtn, Mar 1910, *Domin;* Upper Mudgeeraba, Feb 1931, *Clarke* 9; Buchanan Fort, near Christmas Ck, Apr 1938, *Goy & Smith* 283; Lamington Plateau, *Shirley;* near Currumbin, on railway line between Currumbin and

Tugun, Jan 1931, *G. K. Jackson;* Coolangatta, side of railway bank in grey sand, Jan 1931, *Winders* 12, and Feb 1948, *Clydesdale* 41; Moreton Bay, Bribie I., Apr 1914, *White;* Moreton I., just S of Comboyuro Point, on coastal dunes, Apr 1966, *Blake* 22725, and near Cape Moreton in mixed open forest, May 1937, *Blake* 13065; Stradbroke I., Apr 1910, *Domin,* and at Dunwich, cleared *Eucalyptus* forest, Dec 1931, *G. K. Jackson.*

NEW SOUTH WALES.—Western Plains: Bengalla, *Leichhardt;* Macintyre R. *comm. Pamplin.* North Western Slopes: Warialda, Jan 1931, *Vickery;* Narrabri, Nov 1899, *Maiden;* Mangarah Ck (Barraba District), Mar 1914, *Rupp* 36; near Curlewis along railway, Apr 1917, *Pescott* 4; Narramine, Dec 1892, *Helms;* Liverpool Plains, in 1825, *A. Cunningham,* and [in 1843] *Leichhardt.* Northern Tablelands: Wallangarra, Apr 1914, *Boorman;* Mt Lindsay, Mar 1916, *Boorman;* Kelso, Kangaroo Camp, 30 miles NW of Guyra, 930 m, Apr 1930, *McKie* 366, 699, and Mar 1933, *McKie* 512; Chandler's Peak, Guyra, Mar 1917, *Boorman;* New England, *Stuart* 329. North Coast: Tweed Heads, Oct 1898, *Forsyth;* Casino, Dec 1914, *Irby* 23; Deep Creek, Casino, Apr 1914, *Boggs;* Tatham, May 1905, *Campbell;* Maclean, Mar 1929, *Philp;* Cangai, Upper Clarence R., May 1916, *Boorman;* Gorge District, Clarence R., *Darragh;* Copmanhurst, May 1916, *Boorman;* Orara R., 10 miles S of Ramornie, Jul 1922, *Blakely & Shiress;* Mt Mullengen, 4 miles E of Ramornie, Jul 1922, *Blakely & Shiress;* Grafton, in grassland, not common, Feb 1914, *Wenholz* 12; Bellinger R. on ironbark ridges, Mar 1910, *Swain* B.7; Fernmount, May 1926, *Cheel;* Urunga, Feb 1917, *Lawrence;* Walcha Road, Dec 1912, *Boorman;* Upper Hastings R., Nov 1897, *Maiden;* Upper Landsdowne, on mountain, 300 m, May 1925; *Cheel;* Coopernook State Forest, near Taree, Mar 1936, *F. M. Bailey Jr.* 12; Wingham, along railway, Mar 1910, *Garlick;* 12 miles N by E of Singleton, Mar 1960, *Story* 7157. Central Western Slopes: "Fairfield", Dubbo, Apr 1928, *Hallam;* Dubbo, Oct 1912, *Blakely;* Cassilis, *Leichhardt;* 9 miles NW of Scone, in rocky places on rolling sandstone country with scattered trees, Nov 1959, *Story* 6935; near Scone, in 1885, *Carter* 10; Scone, Aug 1899, *Maiden;* Belltrees, Feb 1920, *H. L. White* 25; Gungal, Nov 1914, *Boorman;* 4 miles NE of Muswellbrook, in *Eucalyptus crebra* woodland with *Aristida,* Mar 1960, *Story* 7094. Central Tablelands: Wattle Ridge, hilltop, Jan 1917, *Cheel.* Central Coast: Wambiral, near Gosford, Aug 1908, *Bea;* Richmond, Apr 1907, *?;* near Windsor, cleared and burnt roadside area, Nov 1960, *M. Gray* 5990; The Valley, Hornsby, Apr 1914, *Blakely;* Bringelly, Apr 1907, *comm. Burnell;* Port Jackson, *R. Brown* [6177], *Sieber Agrostotheca* 54; Parramatta, *Woolls;* Sydney (Rocky Creek, Epping), Jun 1919, *Blakely;* (Cheltenham), on sandstone, Mar 1914, *Carne* and Dec 1947, *Vickery* NSW 4778; (near Hen and Chickens Bay, Parramatta R.), Mar 1890, *?;* (Hunters Hill), Jan 1913, *Blakely* 23; (Homebush), on shale, Jun 1930, *Vickery;* (Five Dock), Apr 1891, *Stephenson;* (Governor's Domain), Jan 1903, *Camfield;* Kogarah, Jan 1896, *Camfield;* Commo, Mar 1899, *Cheel;* Kurnell, Botany Bay, May 1906, *Boorman;* Brownsville near Dapto, Apr 1912, *Cheel;* Albion Park, Mar 1936, *Rodway* 2137. South-west Slopes: Lachlan R., *Suttor.* Southern Tablelands: ca 3 miles S of Tharwa, eastern foothills of Mt Tennent, Feb 1962, *Pullen* 3058; Kambah Park, Murrumbidgee R., among stones at high water mark at foot of stony slope, Jan 1948, *Burbidge* 1847; Naas, Jan 1912, *Cambage* 3475; Cooma, Feb 1930, *Inspector of Stock.* South Coast: Nowra District, Feb 1910, *Boorman;* Moruya, May 1912, *Gannon.*

VICTORIA.—North-East: Mitta Mitta R., *F. Mueller.*

I have also seen specimens from Norfolk I., New Caledonia, New Hebrides (Aneityum), Fiji (many specimens), Samoa, Tonga, Cook Is (Raratonga), Hawaii, Society Is, Tahiti, and Tuamotu Archipelago (Mangareva).

C. refractus differs from the prevailing pattern in the stout upwardly widened trigonous pedicels, persistent pedicelled spikelets, the commonly glabrous callus, joints and pedicels and the usually awnless sessile spikelets; most plants are only weakly, sometimes very weakly, aromatic. Awnless spikelets are characteristic of *C. nardus* var. *nardus, C. citratus, C. winteranus* and *C. cambogiensis* (Bal.) A. Camus. More or less inflated pedicels occur in the Indian *C. microtheca* and in both species there is a tendency for the pedicels to become shorter and more inflated towards the base of the racemes but in *C. refractus* the bottom pedicel of the subsessile raceme remains free and not markedly different from the next one. *C. cambogiensis* from Thailand has sometimes glabrous or nearly glabrous racemes and awnless spikelets as well as subpersistent pedicelled spikelets with thin finely nerved winged lower glume.

While he treated *Andropogon procerus* R. Br. and other species as belonging to *Cymbopogon* and made new transfers Domin treated *A. refractus* as an *Andropogon*. The types of the three varieties that he described represent extreme states. Brown's specimens from Port Jackson at Kew from about 40–100 cm high have ± ciliate joints and pedicels, bearded callus and leaves 1–2·5 mm wide.

The species is widely known as "barb-wire" grass because of the reflexed hard racemes with persistent excurved or hooked pungent-pointed pedicelled spikelets. The mature joints easily disarticulate if brushed against (as is usual in the Andropoganeae) and readily adhere to hair or clothing by means of the pedicelled spikelet which provides a very efficient means of dispersal. Racemes from different inflorescences may become entangled.

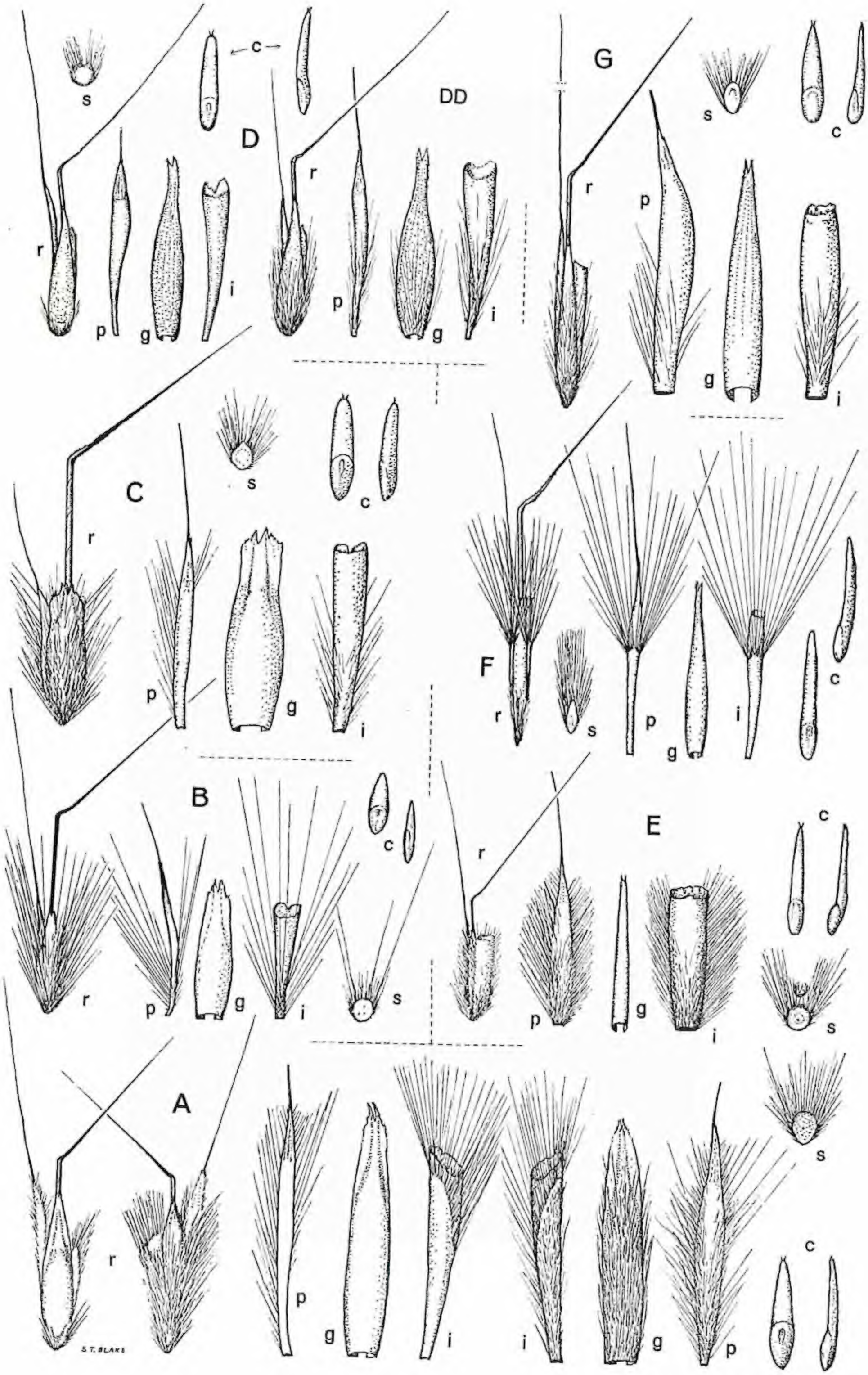
"Kangaroo grass" and "oat grass" have also been reported as common names, but these names are usually used for grasses of other genera.

Some plants have very little smell when bruised and I have never met with any that smelt as strongly as those of other species.

C. refractus appears to produce occasional hybrids with other species. *C. gratus* Domin, Biblioth. Bot. 20, Heft 85:274, fig. 64 (1914) based on specimens from near Chillagoe, Feb 1910, *Domin,* seems to be a hybrid with *C. bombycinus* with foliage resembling that of *C. refractus* and inflorescence more like that of *C. bombycinus. Blake* 8489 from Poison Creek appears to represent another hybrid between these species but resembling *C. refractus;* the old leaf-sheaths are broad, flat and tend to curl, the ligule is longer than in *C. refractus,* the panicle branches more numerous, the lower glume of the sessile spikelet is slightly marginate and scaberulous on the keels, and the joints and pedicels are hairy on the back. It was found with the suspected parents (9489A and 9490). A collection of F. M. Bailey's from Stanthorpe suggests a hybrid with *C. obtectus,* and *Blake* 12719 from Mt Berserker found growing with *C. refractus* (12718) and *C. queenslandicus* (12720) seems to be a hybrid between these having ligules intermediate in length, long ciliate joints and pedicels intermediate in stoutness and ± acuminate (awned) sessile spikelets with a ± winged lower glume.

FIG. 1. *Schizachyrium* spp. A. *S. fragile* B. *S. perplexum*. C. *S. pachyarthron*. D. & D.D. *S. pseudeulalia*. E. *S. occultum*. F. *S. crinizonatum*. G. *S. dolosum*. r. segment of raceme. p. pedicel and pediceled spikelet (most of awn omitted). g. lower glume of sessile spikelet from the back; indumentum omitted from one. i. internode of rhachilla (joint). s. callus scar. c. grain, back and edge views.

r × 6; p, g, i, c × 9; s × 12.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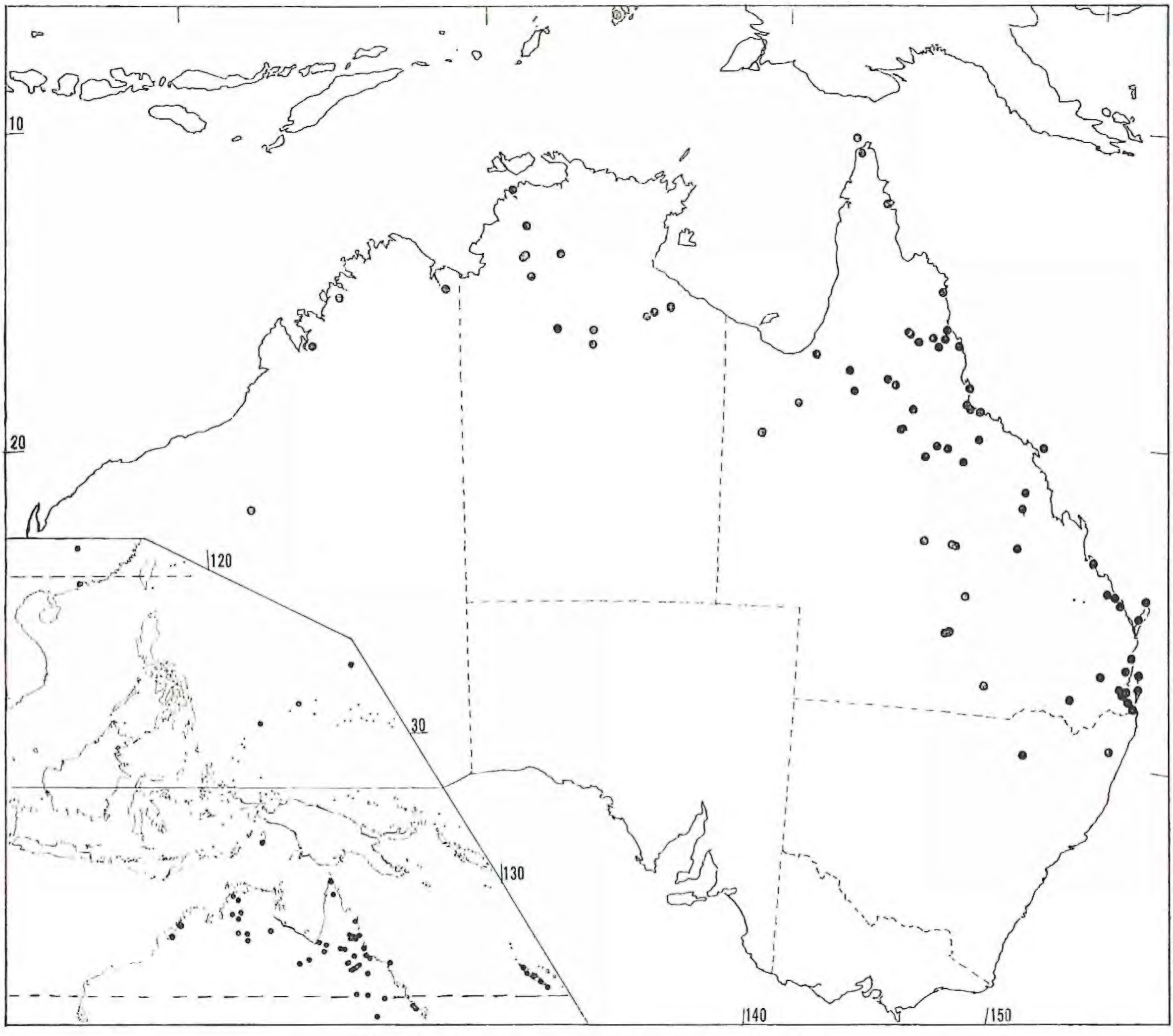

FIG. 2. Distribution of *Schizachyrium fragile*.

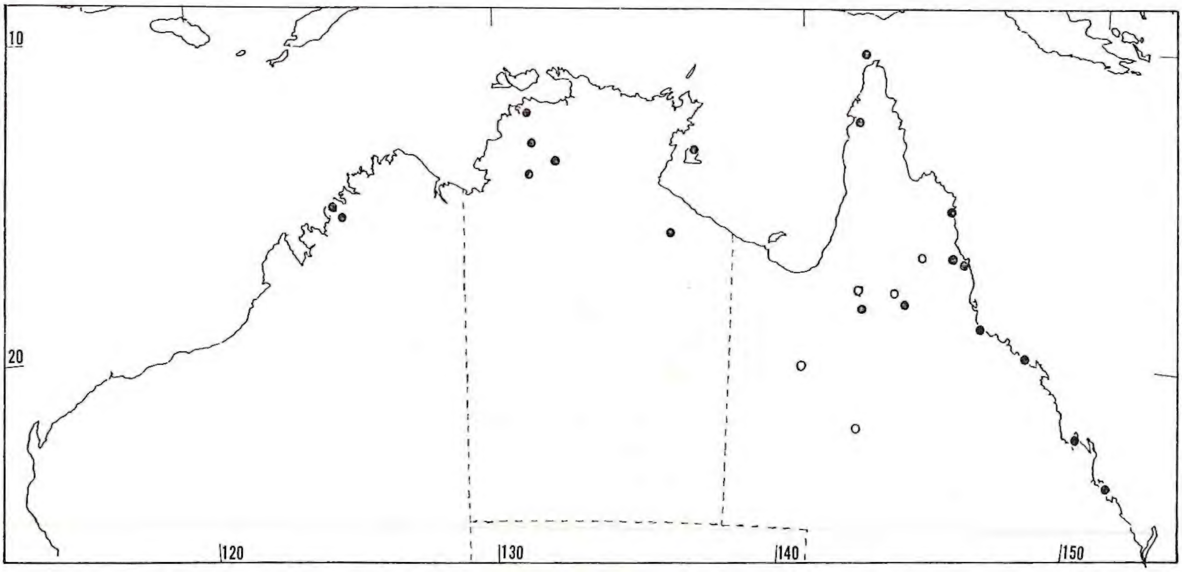

FIG. 3. Distribution of *Schizachyrium perplexum* (o) and *S. pachyarthron* (●).

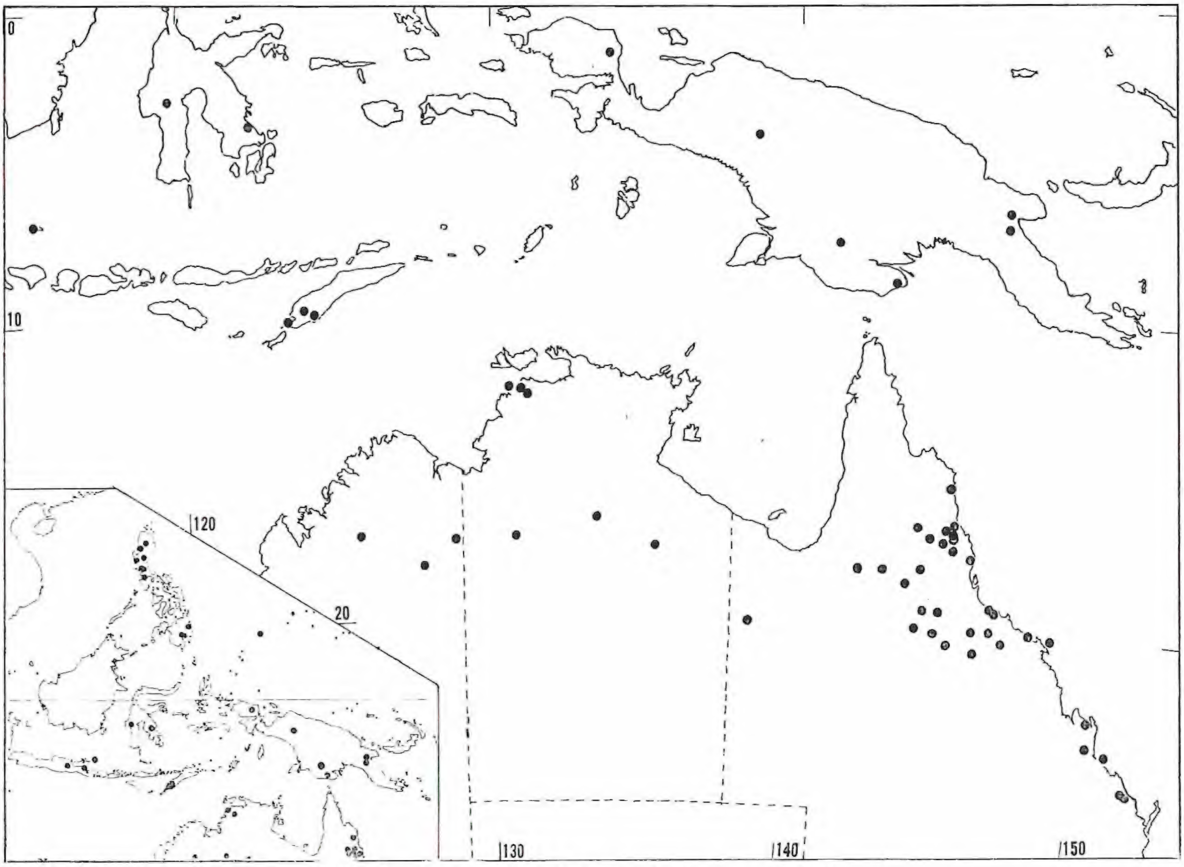

FIG. 4. Distribution of *Schizachyrium pseudeulalia*.

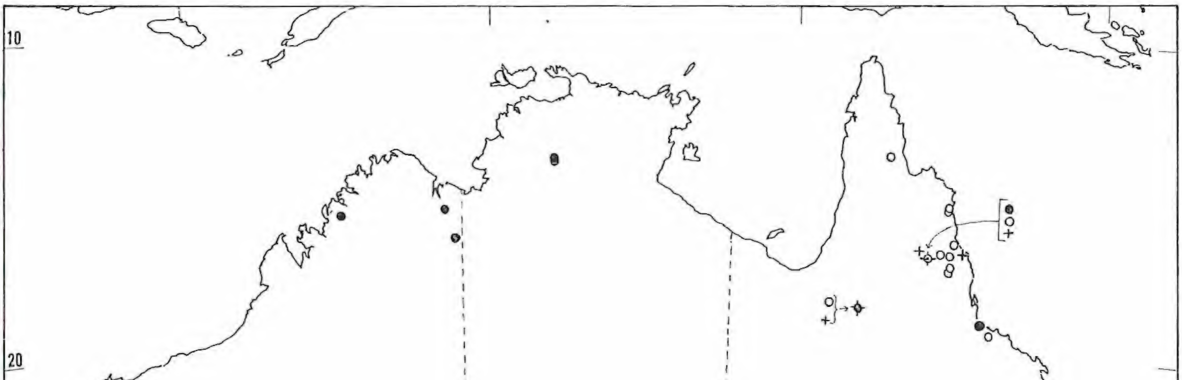

FIG. 5. Distribution of *Schizachyrium crinizonatum* (●), *S. occultum* (o), *S. dolosum* (+).

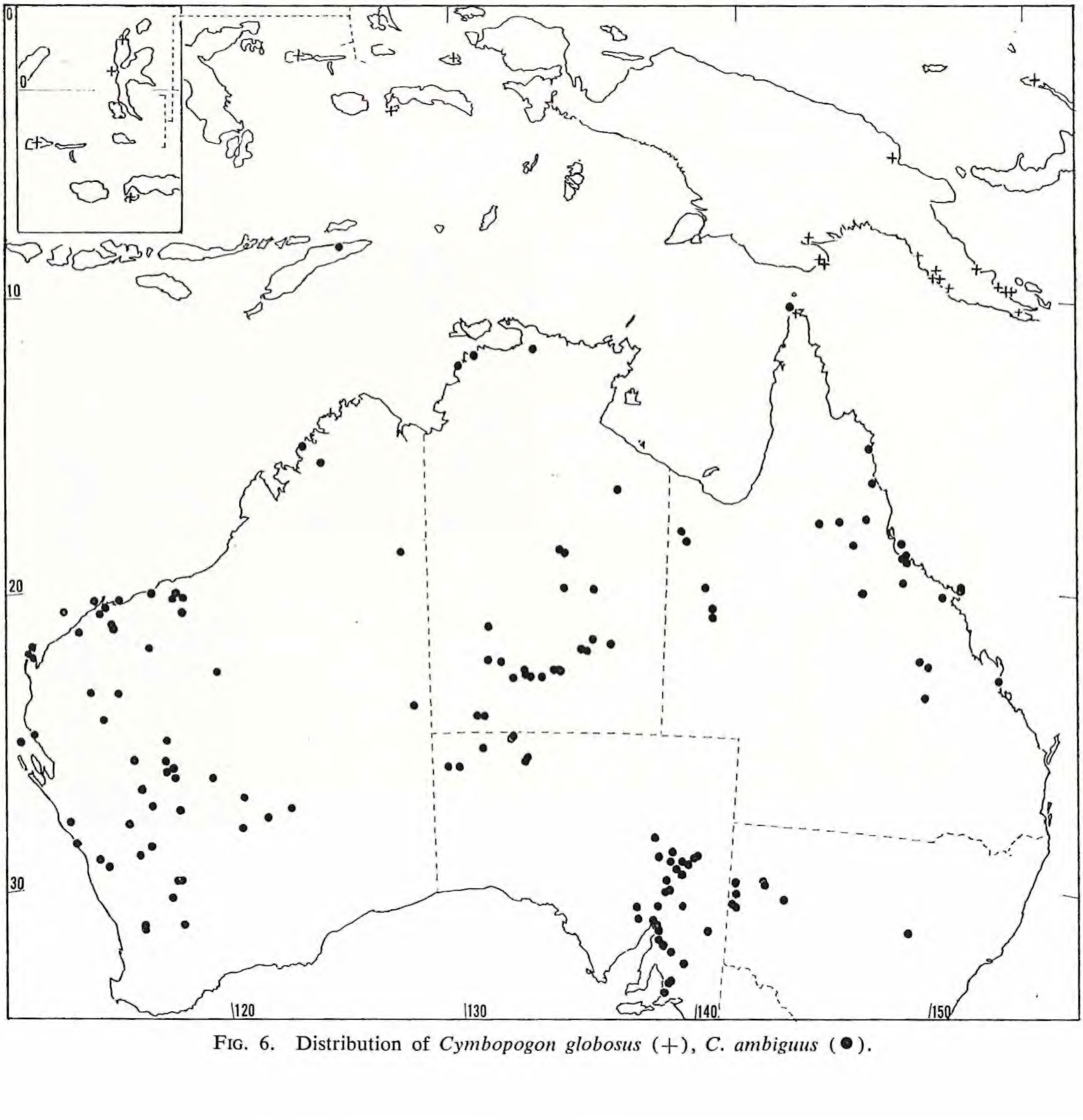

FIG. 6. Distribution of *Cymbopogon globosus* (+), *C. ambiguus* (●).

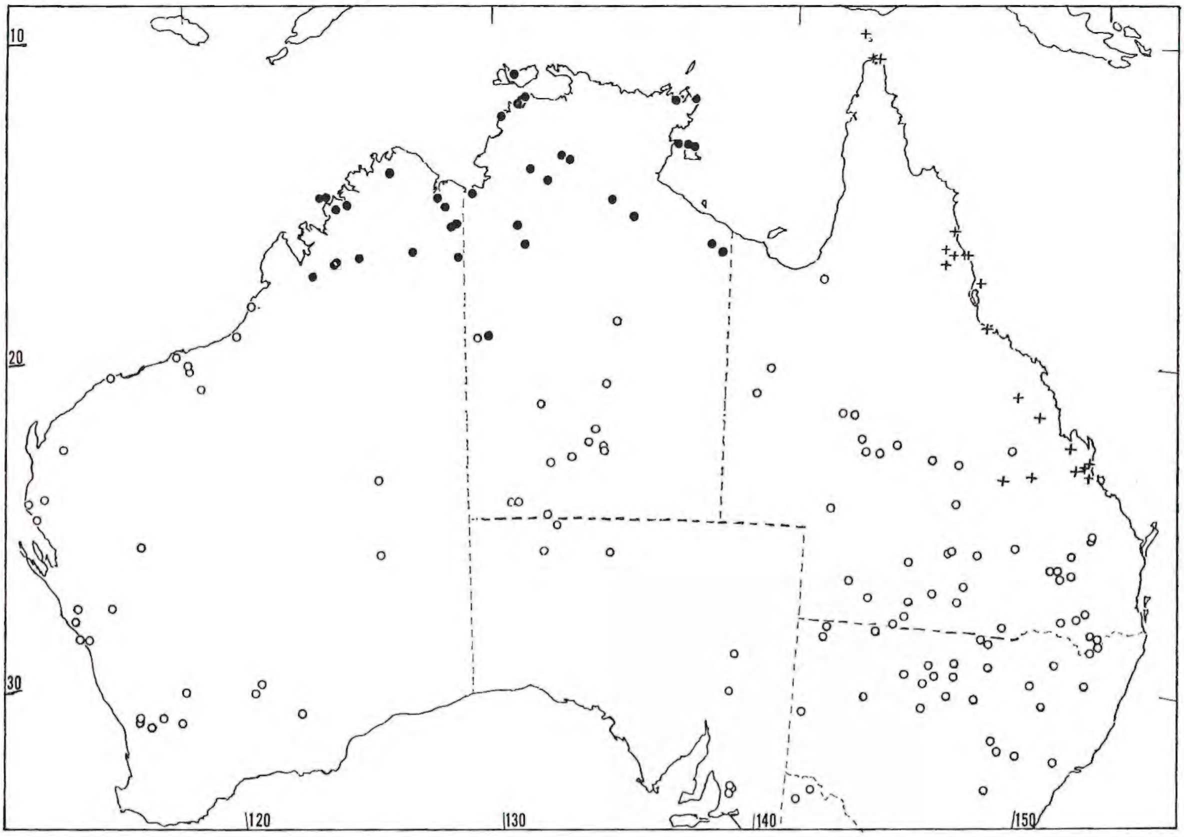

FIG. 7. Distribution of *Cymbopogon procerus* (●), *C. obtectus* (o). *C. queenslandicus* (+).

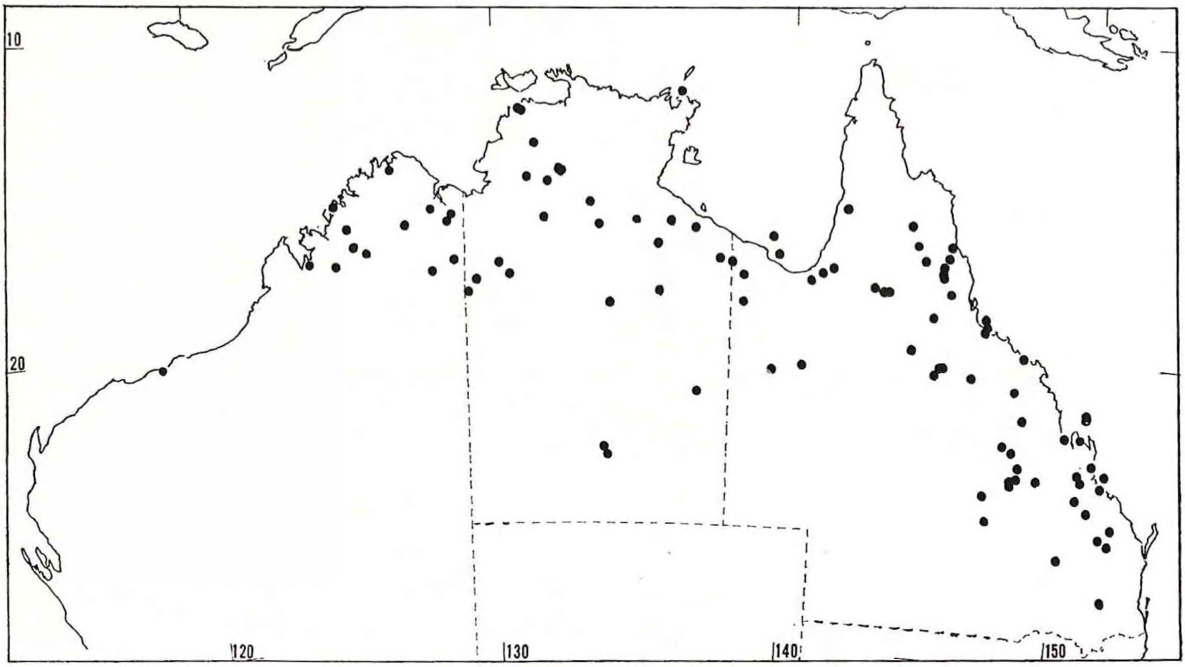

FIG. 8. Distribution of *Cymbopogon bombycinus*.

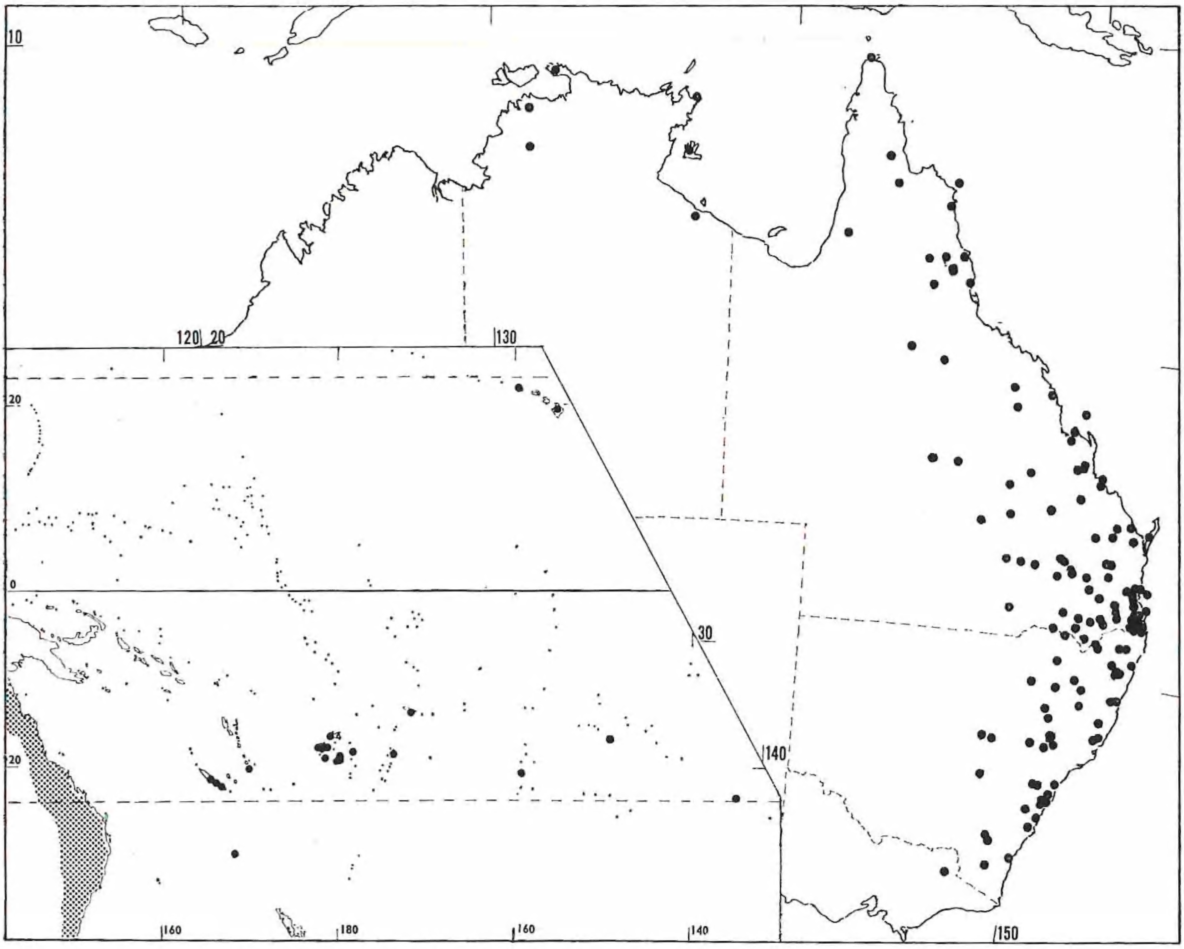

FIG. 9. Distribution of *Cymbopogon refractus.*

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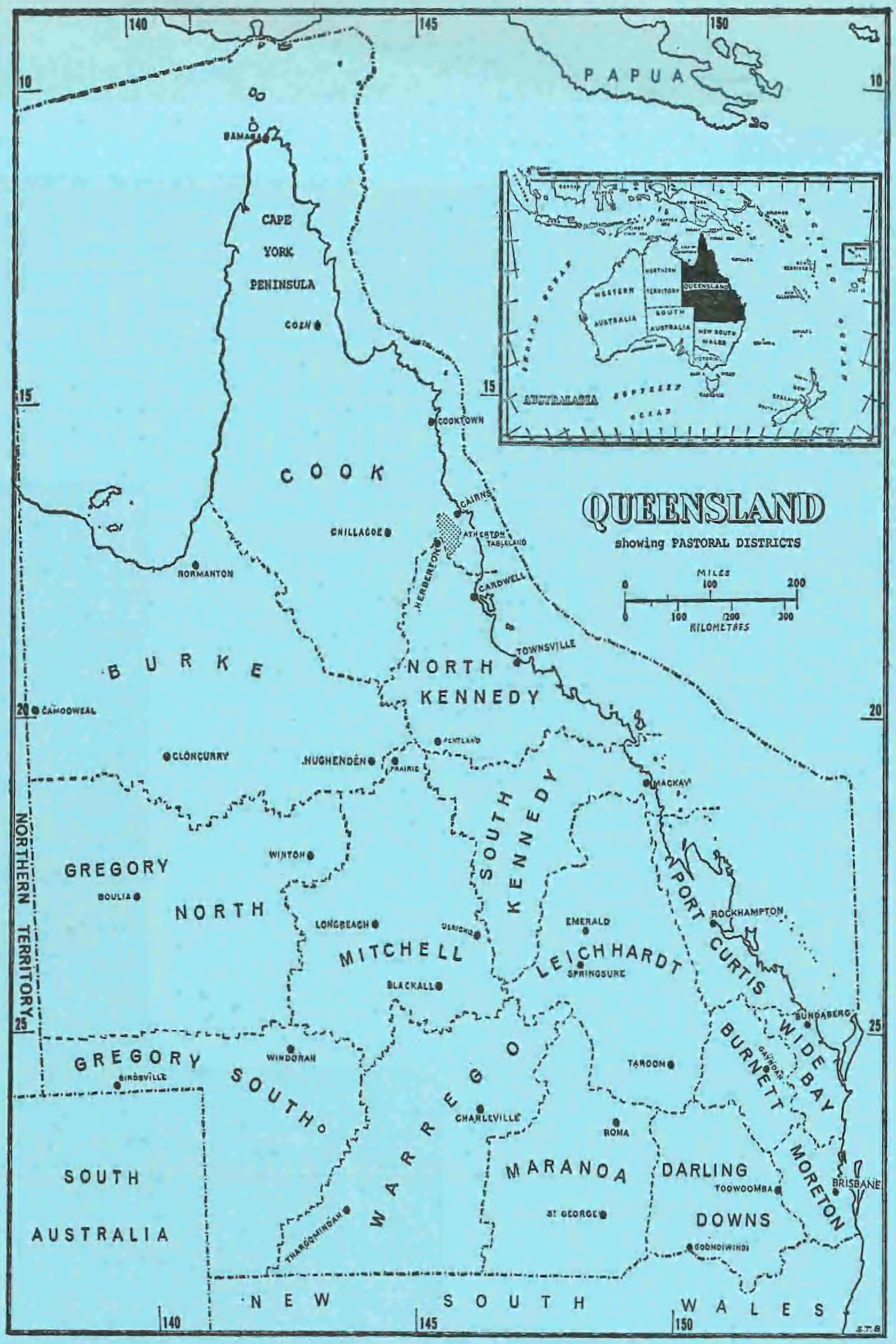

In the citation of specimens from Queensland, the localities are grouped according to the Pastoral Districts shown above. The boundaries of these Districts mostly follow watersheds except for those between North Kennedy District and South Kennedy District and between Gregory North District and Gregory South District.

Compiled from maps issued by the Survey Office, Department of Lands, Brisbane; based on State Map 4a.

CONTRIBUTIONS
FROM THE
QUEENSLAND HERBARIUM

Papers are numbered consecutively, paged independently and issued at irregular intervals. Those previously published are

No. 1. A Revision of *Melaleuca leucadendron* and its Allies (Myrtaceae).
By S. T. Blake. Published 27th May, 1968.

No. 2. *Podolepis monticola,* a New Species of Compositae from Queensland.
By R. J. F. Henderson. Published 9th September, 1969.

No. 3. A Cytological Study of *Lantana montevidensis* (Spreng.) Briq. in Queensland.
By R. J. F. Henderson. Published 9th September, 1969.

No. 4. Notes on *Acacia,* chiefly from Queensland, III.
By L. Pedley. Published 9th September, 1969.

No. 5. Intermediates between *Eucalyptus populnea* F. Muell. and *E. brownii* Maid. & Cambage.
By L. Pedley. Published 9th September, 1969.

No. 6. New Species of and Notes on Queensland Plants. V.
By L. S. Smith. Published 9th September, 1969.

No. 7. A Revision of *Carpobrotus* and *Sarcozona* in Australia, Genera Allied to *Mesembryanthemum* (Aizoaceae).
By S. T. Blake. Published 9th September, 1969.

No. 8. Studies in Cyperaceae.
By S. T. Blake. Published 9th September, 1969.

No. 9. A Revision of *Plectranthus* (Labiatae) in Australasia.
By S. T. Blake. Published 23rd April, 1971.

No. 10. *Trachymene cyanantha,* a new Species of Umbelliferae from Queensland.
By D. E. Boyland. Published 4th September, 1972.

No. 11. A Revision of *Acacia lycopodiifolia* A. Cunn. ex Hook. and its Allies.
By L. Pedley. Published 4th September, 1972.

No. 12. *Idiospermum* (Idiospermaceae), a new Genus and Family for *Calycanthus australiensis.*
By S. T. Blake. Published 4th September, 1972.

No. 13. *Neurachne* and its Allies (Gramineae).
By S. T. Blake. Published 4th September, 1972.

No. 14. *Plinthanthesis* and *Danthonia* and a Review of the Australian Species of *Leptochloa* (Gramineae).
By S. T. Blake. Published 4th September, 1972.

No. 15. Notes on *Acacia,* chiefly from Queensland, IV.
By L. Pedley. Published 18th March, 1974.

Now simultaneously published are

No. 16. *Solanum nigrum L.* (Solanaceae) and Related Species in Australia.
By R. J. F. Henderson.

No. 17. Revision of the genera *Cymbopogom and Schizachyrium* (Gramineae) in Australia.
By S. T. Blake.